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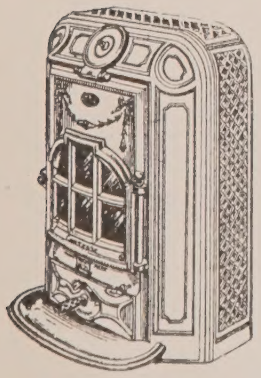

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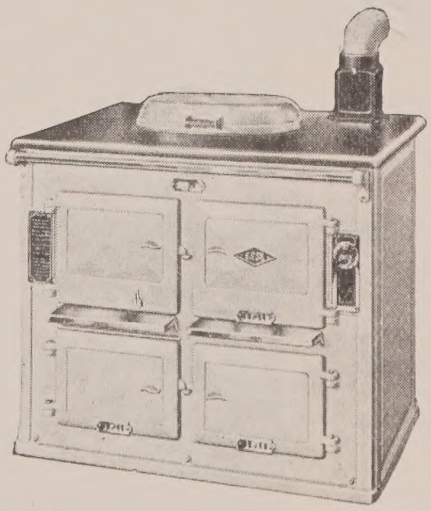

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The Journal of the National Smoke Abatement Society

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The Journal is open for free discussion of all aspects of the smoke problem, and the opinions expressed in contributed articles are not necessarily the same as the views of the Society. Quotations and abstraction of matter appearing in the Journal is welcomed, provided the usual acknowledgements are made.

COMMENTARY.

IT IS with deep regret that we learn of the sudden death of Sir Frank Baines. For a few months only have we had the privilege of including him among our Vice-Presidents, and the invaluable paper that he read to us during the summer is, at the time of writing, in the course of being printed. Sir Frank was one of the few architects who fully understand the havoc to buildings caused by coal smoke and fumes, and characteristically, he went into the problem with great thoroughness, as is shown by the care with which he prepared this paper. It was in the paper that he read at Manchester in 1924 that he so eloquently indicted the smoke evil as "the significant destructive canker which descends upon and eats into the everlasting granite, and debases 'marble and the gilded monuments of Princes'; that renders unintelligible the writings of history, annihilating the authentic record of tradition; and finally which appears to show that modern progress and accomplishment, as if in critical disdain, carry within themselves elements of destruction and decay for their own achievement." Sir Frank, when Director of H.M. Office of Works, estimated that his department spent £120,000 a year on the upkeep of Government buildings directly due to the effects of smoke; and his more recent calculation, that the action of smoke upon buildings has cost £60,000,000 during the last quarter of a century, has, because of the authority behind it, been one of our most widely used statistics. In the unexpected death of Sir Frank Baines the smoke abatement movement has lost one of its most influential friends.

It is probable that by the time this issue of the *Journal* appears the winter drought will have ended and the land will have been washed clean by the much needed rain. But at the moment the effects of smoke deposit have never been so noticeable. For weeks there has been no real rainfall and but little wind, and fog has trapped and brought down the concentrated solids. Everywhere there is a coating of dry dirt, and even in the outer suburbs the grass is grey and choked. Sacking tied round newly transplanted cypress trees for protection during frost showed, when it was removed, a comparatively vivid band of green below the grimy exposed portions. On one damp and misty morning in Manchester the streets were thick with accumulated slime, that made walking a slippery and difficult task. But as usual all this will remain unnoticed by the great majority of people, or, where they do notice it, they will lay the blame wholly upon the absence of rain. The dirt is, to them, perfectly natural; the only unnatural and harmful thing is a drought in winter. And of course nothing can be done about that.

There have been an unusually large number of controversies by newspaper readers on smoke abatement during the last few months, including, as usual, a fresh attack on smokeless mediums in the Lancashire and Cheshire papers by the gentleman who was mentioned in the last issue of the *Journal*, and who now informs the world that you can have too much of good things, including both sunlight and smoke. A little more serious than this is Mr. Filson Young, well-known to broadcast listeners, who in one of his weekly articles in the *Radio Times*, asserted that winter in London was bearable to him only because of the warmth and cheerful comfort of his coal fire. The *Radio Times* was good enough to print two letters of protest to such a deplorable sentiment, one from Dr. H. H. McWilliam, a member of the Society, and one from the Society's secretary. In a footnote to the latter the editor of the B.B.C.'s responsible organ stated that while Mr. Young sympathized with the Society's views he would continue to use his coal fire. We hardly think that it was intentional, but on the cover of that issue of the *Radio Times* was an aerial photograph of Broadcasting House, gleaming white and beautiful among its black and almost undistinguishable neighbours. As the atmospheric degradation of this gracious new building continues, and Prospero and Ariel crumble away to calcium sulphate—but the irony of it all is enough. We can but compare Mr. Filson Young's sentimentalism with the keen vision shown by the quotation given in the first of these paragraphs.

We have received a copy of "Smoke," the new monthly bulletin of the American Smoke Prevention, and are glad to welcome this evidence of further activity for pure air from the United States. Elsewhere in this issue we review an important new book just received from that country, and we should like to see a more frequent interchange of news and views between the organizations that are working for identical reforms on both sides of the Atlantic. In Britain the industrial depression does not seem to have affected domestic smoke emission and has certainly diminished that from industrial sources, but in the United States, according to the notes in the Bulletin by Mr. Frank H. Lamping of the Cincinnati Smoke Abatement League, the depression is responsible for a set-back to the movement. People have reverted to cheaper and smokier forms of heating and have neglected to renew and repair equipment. Mr. Lamping says that the smoke abatement organizations in the cities must begin anew to regain the ground they have lost because of these conditions. They must re-educate the public in the use of proper fuels and promote the discarding of antiquated and obsolete equipment. The Annual Convention of the Smoke Prevention Association will be held in Buffalo in June of this year, and receives our good wishes for its success.

One of the most outstanding and highly appreciated forms of publicity during the past few years was the display frames of the Empire

Marketing Board, and there was general regret when the scheme was ended. The frames, however, have been handed over to Local Authorities who would undertake to use them for health propaganda purposes, and about 275 frames, or possibly more, are to be used for this purpose. It has not yet been finally settled, but it is expected that these will be utilized by posters to be supplied by the national health associations through the agency of the Central Council of Health Education. The National Smoke Abatement Society is one of these bodies, and it is therefore hoped that before the end of this year readers will be able to see smoke abatement posters on these frames in many of our towns and cities.

Mr. J. W. SEFTON.

There are many engineering firms in this country whose product or appliance might profitably be brought to the notice of municipal authorities, with a view to being adopted as a smoke-abating measure. Mr. J. W. Sefton the sole advertisement representative of this *Journal*, has made very full and thorough inquiries into the *practical* steps which many municipalities are prepared to take, in their efforts to reduce the smoke nuisance. Personally acquainted with medical officers of health and borough engineers in many large towns, Mr. Sefton is well-informed on their requirements, and is able to supply much useful information as to the methods most favoured. Reliable data on the experiences of municipal officers with measures already adopted, is most valuable, and Mr. Sefton willingly offers this service, without obligation to the inquirer. His address is :—

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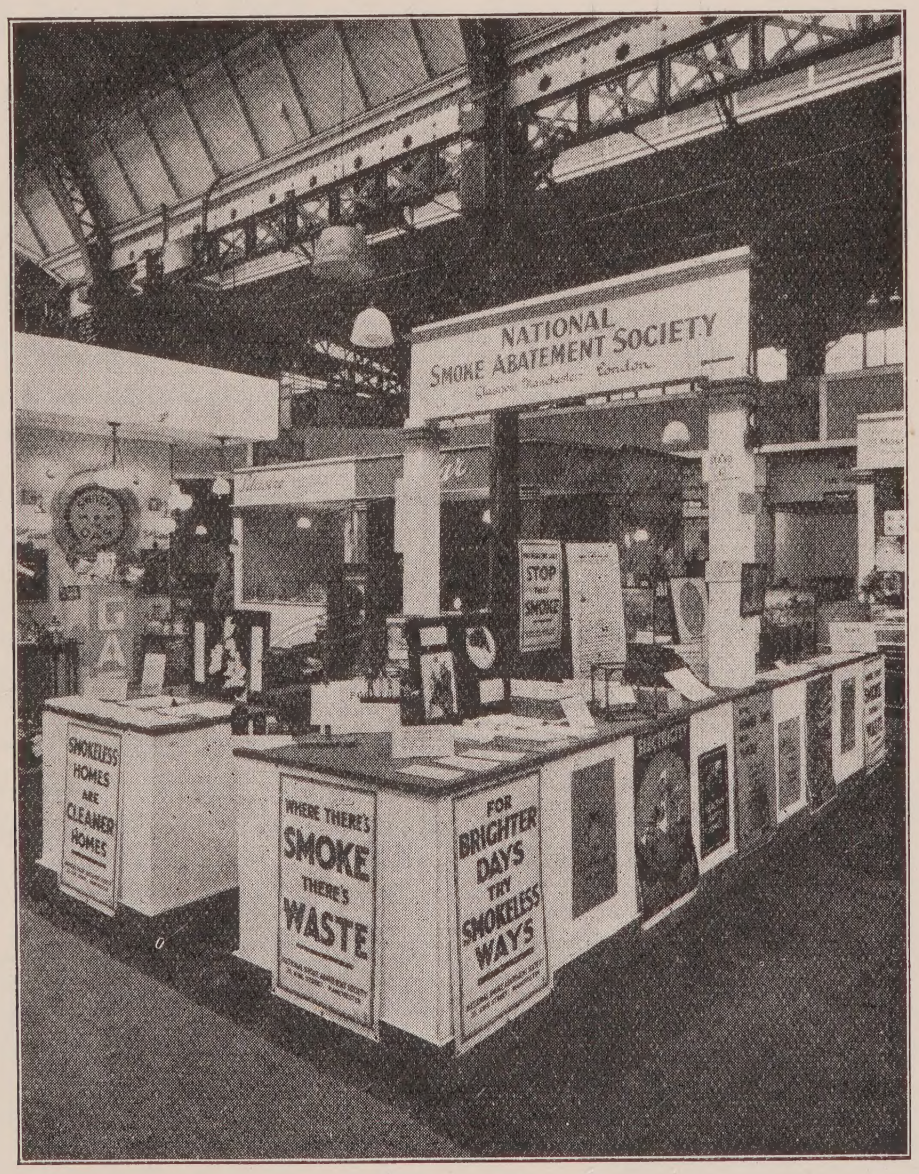
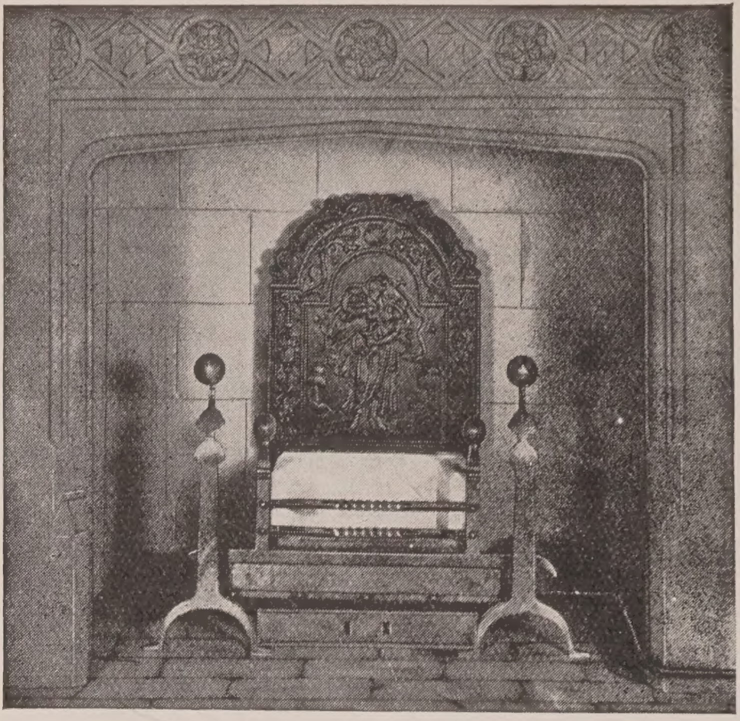

NATIONAL SMOKE ABATEMENT SOCIETY
Glasgow Manchester London
STOP SMOKE
SMOKELESS HOMES ARE CLEANER HOMES
WHERE THERE'S SMOKE THERE'S WASTE
FOR BRIGHTER DAYS TRY SMOKELESS WAYS

The National Smoke Abatement Society's Stand at the recent "Domesticities" Exhibition at the City Hall, Manchester.



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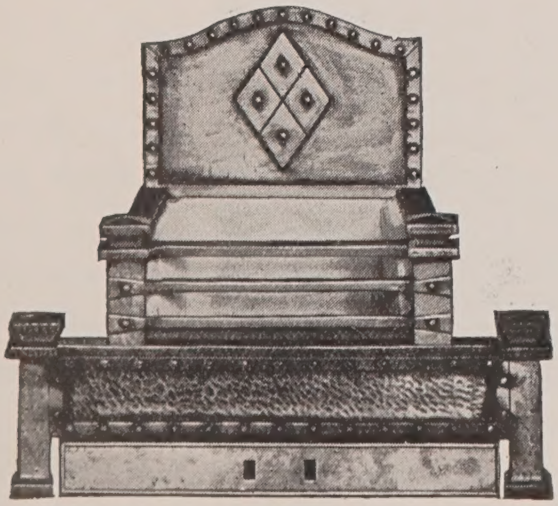

Stopping Smoke in the U.S.A.

Pamphlets and papers on aspects of the smoke problem have been more numerous than ever during the last few years, but it is some time since a full-sized text-book on the subject as a whole has been published.

An important work now appears from the United States, and as it runs to 289 pages it may be said to cover the ground as completely as possible. STOP THAT SMOKE! is by Henry Obermeyer, and is published by Harper Brother, New York and London (Price in this country: 10/6 nett). Copies may be purchased in Great Britain through the National Smoke Abatement Society, which has obtained a supply for sale to its members and others.

Mr. Obermeyer, in his preface, says that the book is written in non-technical language, by a layman from the public's point of view. He may have been a layman before he began the book, but he can hardly claim to be one now that he has assimilated and presented in such eminently attractive form the mass of information that the book contains. He is, indeed, in danger of becoming an expert.

Conditions in America.

Much of this information is of direct value and use to British smoke abatement workers, but a great deal of the interest to readers on this side of the Atlantic lies in the picture that it gives us of conditions in America, of the way in which the problem is regarded by the public and by responsible opinion, and of the uses of legislation and propaganda. When, however, the slight differences of outlook and conditions (especially the differences in domestic heating) are allowed for, we find that our friends in the States are faced with a problem identical with our own, and have to overcome the same obstacles of apathy and the belief that smoke is a natural and inevitable concomitant of modern industrial and urban life.

It is difficult to judge which country has the more difficult task. The author shows that in his country organization is scattered and the campaign is frequently sporadic. He is good enough to state that "The National Smoke Abatement Society, with headquarters in Manchester, England, is a highly successful example of smoke-fighting on a comprehensive scale." We, however, can look with envy upon the great campaign in Salt Lake City which resulted in a 96% reduction of smoke in five years, and can blink our eyes at the fact that the Citizen's Smoke Abatement League of St. Louis is expending a budget of £50,000 on propaganda and administration.

New York, Cleveland, Pittsburgh, St. Louis, Boston, Salt Lake City, Columbus, and Cincinnati are among the cities that have undertaken campaigns and passed ordinances against the smoke nuisance, but there appears to be little national effort linking up these separate movements. The National Smoke Prevention Association and the National Conference Board on Sanitation are the principal bodies operating on a national scale. Many local women's clubs, chambers of commerce, technical and civic organizations, including Boy Scouts, have from time to time, in various places, performed services of exceptional value. The newspapers, too, have frequently been powerful allies to the movement.

It is apparent, then, that there does exist in the United States a body of influential opinion well-informed of the consequences of atmospheric pollution, and it may be that this is much larger and more active than the corresponding opinion in this country.

Smoke in New York.

Many people in Britain are under the impression that the use of bituminous coal is prohibited in New York City, and that this is therefore a paragon in a polluted world. Mr. Obermeyer states that the American public also labours under this misconception. But, however, there is no such law upon the books. A former Health Commissioner declared "We cannot conceive a law so drastic that it would attempt to regulate the type of fuel to be burned, owing to the fact that the reasons controlling coal consumption are too varied and subject to too many outside forces that are difficult to control."

Mr. Obermeyer is doubtful of the benefits of legislation of this type:

"Enforcement of the law requires co-operation on the part of a substantial majority of the people. Moreover, the courts have decided that municipalities may not be made defendants in suits because of neglect to enforce certain ordinances, which means that municipalities cannot be compelled to enforce ordinances. Consequently smoke ordinances must be reasonable in scope, and violations should be prosecuted only when all other agencies of education, persuasion, and the like have utterly failed. It is doubtful, for example, if any law could be enforced which absolutely prohibits the burning of soft coal or provides that the consumer thereof is liable to a fine."

A much more valuable type of control, which is unknown in this country, is to supervize the installation of plant according to a definite code. This has been done in Germany and is common in the United States:—

"Common sense must make us realize that is is somewhat absurd to keep on taxing ourselves to maintain a force of smoke inspectors simply to check the density of smoke from a plant which could not possibly be operated smokelessly. Thus the majority of smoke ordinances throughout the country to-day provide for a system of licenses or permits for the installation of boilers or other heating equipment. Generally such

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permits are issued after assurances that the installation in question conforms to an established specification or code. The section of the smoke ordinance covering the routine issuing of permits usually reads as follows :

> No new plant or chimney, or any reconstruction of any old plant or chimney, for producing power and heat, or either of them, shall be constructed, enlarged, altered, and operated or maintained in the city until plans and specifications of the same have been filed by the owner, agent or contractor in the offices of, and have been approved by, the chief smoke inspector, and a permit issued by him for such construction, reconstruction, or maintenance."

Smoke Prevention Codes.

" In no instance where permits are granted does the holding of a permit preclude prosecution for violating the smoke ordinance. The tendency to establish detailed standards of construction is based on the thought that the simplest and surest way to eliminate smoke from the air is to make it mechanically impossible in the boiler-room. Usually a code which specifies the limits of a boiler, furnace, or chimney stack is incorporated in or made supplementary to the regular smoke ordinance.

" It is chiefly a matter of recognizing what every combustion engineer knows at a glance, namely, that there are certain physical relations, such as maximum size of boiler to be allowed with hand-fired grates ; setting heights for boilers, both hand-fired and stoker-fired ; limiting or excluding the installation or use of certain types of equipment which are impossible or difficult to operate without making smoke—and so forth. The suggested ' standard ordinance ' proposed by the American Society of Mechanical Engineers is a step in the right direction when properly modified or expanded to meet local conditions.

" There is no doubt that the code is of value. First, it gives manufacturers an idea of the conditions under which they must bid for work in the territory involved, and, in a sense, places them all on an equal footing. Secondly, it also standardizes official procedure instead of leaving each individual case to the judgment of the smoke inspector or his deputies. If the code is not written into the ordinance, there is danger of alterations being made from time to time through changes of office personnel, until it becomes so mutilated as to be unrecognizable."

There are cities which have adopted a " license " system, and it is apparently a question under discussion whether it is desirable to extend this or not. If fees are charged for the granting of permits or the inspection either of plans or of the plants themselves it is claimed that the income thus accruing will help to defray the costs of administration. It is said that " some advocates of the license system see in this an opportunity for the anti-smoke programme to be self-supporting, if not actually a source of profit to the municipality," and that " whatever the practical difficulties, there is no doubt that the adoption of such a system would go a long way towards obtaining satisfactory appropriations for smoke abatement. This amount, from observation in various campaigns throughout the country, has been estimated at a minimum of $50,000 a year per million of population. It has been frequently pointed out that this figure constitutes an insurance rate of only 0.3 per cent. on the per capital loss and damage in the community."

It might be well to remember this figure of £10,000 per million as far as this country is concerned.

The principal objection, it is stated, to the license or " service " fee system, is that it brings smoke abatement into politics by making it profitable to grant or withhold permits, and therefore opens the door to discrimination. Mr. Obermeyer also says that there is a " great deal of merit in the principle that the cost of smoke abatement should be shared, as far as possible, by those who reap its benefits—meaning every man, woman, and child within the area covered. Those who make the smoke should be cured or punished. Those who co-operate with the city authorities in keeping the atmosphere clean should not be penalized by red tape and fee systems, which may easily be abused."

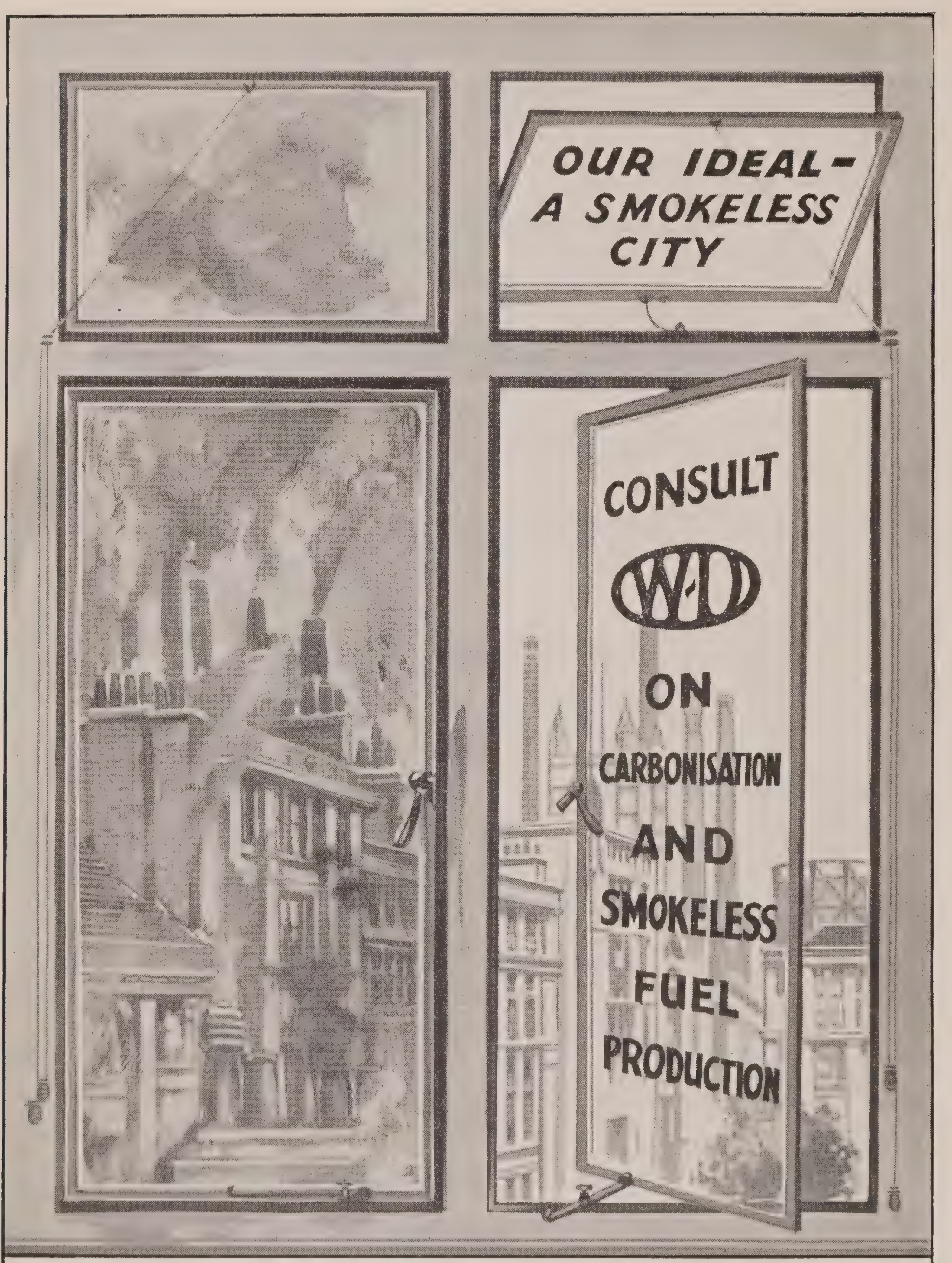
Limits of Emission.

The problems in this country over the definitions of " black " smoke and " dense " smoke are familiar, but do not appear to have arisen in the same way in the United States. Until 1926 the term " dense smoke " without a precise definition was in general use, but, as might be expected, the many variable factors made this a matter difficult to determine. In 1926 the phrase was defined by specific reference to the Ringelmann chart, and this has now been generally accepted, although there is still a wide variance of opinion as to how it should be applied.

As a rule shade No. 3 in the chart, and higher, is considered to be dense. In Boston density is limited to No. 2. An emission of six minutes per hour is the general limit which constitutes a nuisance, and it is said that this has been found ample, in the present stage of smoke abatement, to get satisfactory results. In Pittsburgh, however, and in certain other places, there is a limit of two minutes in fifteen with smoke of No. 3 Ringelmann density.

It is recognised, as in Britain, that " the real probelm of to-day is the small heating plant." Mr. Victor J. Azbe, of St. Louis, a leading authority on the subject states that " smoke abatement departments now devote 80 per cent. of their energy to large plants and 20 per cent. to small. This order should be reversed.

Smoke from private residences is generally specifically exempted by the ordinance, provided that the premises are intended for the occupancy of not more than five or six families. Larger apartment houses generally must conform to the law. Cleveland is one of the few cities to-day in which *all kinds of property*



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are included in the prohibition. Schenectady has withdrawn the exemption for residence smoke that was originally in its law. One can confirm Mr. Obermeyer's warning that too-inclusive legislation may antagonize the public, and that "a drastic ordinance does not usually accomplish the desired results."

There are now over 200 cities with smoke abatement ordinances, whereas fifteen years ago there were only twelve, out of approximately 240.

The Power of Persuasion.

Mr. Obermeyer, in a valuable chapter with this title says "Education, rather than a campaign of active prosecution, is the only real hope of dealing with the smoke problem under present conditions . . . . education and persuasion, if successful, will result in permanent improvement, whereas the success of other methods depends entirely upon eternal vigilance and legal force. We have already noted that the best kind of persuastion is that which appeals directly to the enlightened self-interest of the offender."

An amusing prophecy arises out of a statement by a former president of the British Institute of Mining Engineers, who declared that "A very few years may see it a penal offence to burn coal. The popular view is that coal is something to be burned. The scientific view is just the opposite—that coal is too valuable to be burned; that to burn it is to squander it." Commenting on this the Philadelphia *Record* projected its imagination sixty years hence to a court-room in which a trial has just taken place. The judge, in giving sentence, says:

> "You have been convicted—justly, the Court believes—of a grave offence. The evidence is conclusive that by devious means you procured from a bituminous bootlegger a ton of coal and burned it to heat your home. The court gives due weight to your previous good character and to the fact that you were following a custom once widespread and lawful. But it is necessary to make an example of you, as a deterrent of such reckless crimes against the law, against society, against nature itself. The sentence is that you shall pay a fine of $1,000 and be imprisoned for one year."

Other Aspects.

Other aspects of the smoke nuisance are dealt with very fully in "Stop That Smoke!" Chapter headings entitled "The Challenge to Health," "We Lose our Sun," "A Threat to Property," and "The Waster of Cities" give vivid pictures of the many evil consequences of the evil, and the book concludes with practical chapters on fuels and firing, the principles of furnace operation, and the need for correct and skilful stoking. Space will not permit more than a passing reference to the exposition of these subjects as it is made in the book, a study of which is essential for its proper understanding.

The value of clean air and ample sunshine to health and well-being is rightly stressed, and among the many items the following extract from a report upon the effects of light and surroundings upon school-children may be re-quoted:

"A spotless town is a more moral town than an air-polluted town. It is hard to have clean children in a dirty town, and physical dirt is closely related to moral dirt, and both lead to degeneracy. It is too much to expect good results in schools that exist in an air-polluted atmosphere. We cannot imbue the young with a sense of beauty when beauty itself is bedaubed."

In another place Mr. Obermeyer quotes the words of a former president of the American Chemical Society:

"While we have made marvellous advances in cures for human ills, in bacterial control, in hygiene and sanitation, so far as water and waste are concerned, sanitation of the air stands to-day just where it did one hundred years ago."

This book, however, will be a material factor in assisting that urgently required advance to be made. It is intended for the United States, but it will be of profit to us in our own smoke-blackened country.

Mr. Randolph A. Glen

As the *Journal* goes to press we learn, with great regret, of the death, on January 20th, of Mr. Randolph Alexander Glen, Standing Counsel and Hon. Adviser on Legislation to the Society.

Mr. Glen was Recorder of Penzance and was also standing counsel to the Commons, Open Spaces, and Footpath Preservation Society, the Council for the Preservation of Rural England, and the Pure Rivers Society. He specialized in local government cases, and was the author of "Public Health," "Glen's Local Government Act," "Glen's Town Planning and Housing," and "Glen's Public Assistance."

He was educated at Charterhouse and Christ's College, Cambridge, where he graduated M.A., and LL.M. He was called by the Middle Temple in 1898 and joined the Western Circuit. He was appointed Recorder of Penzance in 1930.

Mr. Glen was the leading authority on smoke abatement legislation, and for many years his co-operation and advice with the Coal Smoke Abatement Society, and latterly with the National Smoke Abatement Society, has been invaluable. He was completing, at the time of his illness, a new standard pamphlet, to take the place of that by Mr. Joseph Hurst, on "The English Law Relating to Smoke Emission."

On behalf of the members of the Society a letter has been sent to his widow and sons expressing our regret and sympathy to them in their loss.

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Smoke and the Atmosphere

Dr. J. R. Ashworth, of Rochdale, will be well-known to most members of the National Smoke Abatement Society, of which he is a member of the Executive Committee, and his extensive work upon atmospheric pollution will be familiar to all. The results of many of his investigations have now been brought together in a volume entitled "Smoke and the Atmosphere: Studies from a Factory Town." (Manchester University Press, 7/6). It may be purchased direct from the National Smoke Abatement Society.

We owe a great debt to Dr. Ashworth for the invaluable work that he has carried out, for the most part single-handed, in Rochdale during the last eighteen years. In the sections dealing with the deposit gauge the book is a valuable commentary upon the reports issued by the D.S.I.R. Committee for the Investigation of Atmospheric Pollution, in that they discuss the practical problems that are associated with this method of measurement, and also because of the striking analyses of the variation in deposit for one particular town. The variation of deposits in time, the effects of coal stoppages and holidays, the proportions of domestic and industrial smoke—much useful information is to be gathered from the deductions that Dr. Ashworth makes from his observations of Rochdale's sootfall.

The Effect of Wind.

One of the most interesting chapters is devoted to experiments with a horizontal gauge, in which the pollution carried by the wind is caught and measured. The usual deposit gauge measures only the matter that is deposited in a given place and is not a measure of the matter suspended in the atmosphere. We know that smoke is carried considerable distances from its source of origin, and Dr. Ashworth himself shows that rain or snow brings down large quantities of impurities that otherwise would not have been detected.

Gauges were therefore constructed with their openings facing the horizontal, so that the matter carried along by the wind would be trapped and deposited. A further gauge was controlled by a vane in such a way that the orifice always faced the wind. The revolving gauge was found to catch the greatest amount of impurity, averaging per month no less than 236.3 tons per square mile. It was also found that the greater the distance from the source of pollution the greater was the proportion of soluble to insoluble matter. It is considered probable that the soluble matter is less dense than the insoluble and so remains longer in the air and is not so readily deposited. The amount of soluble matter measured by the horizontal gauge, compared with that measured by the deposit gauge is in the ratio of 13 to 1.

Dr. Ashworth concludes this chapter by saying:

"If the pollution existing in the air at any place is required the 'horizontal' type of gauge would appear to give results nearer the truth than the deposit gauge. In any case, it would be desirable for the deposit gauge to be supplemented with another type of gauge which would enable a reasonable estimate to be formed of the total amount of impurities in the air, which is the sum of that which drifts past as well as that which is deposited at the place where observations of atmospheric pollution are being made."

Pollution Hour by Hour.

Observations made by the daily deposit recorder, also devised by Dr. Ashworth, is a source of much practical knowledge regarding the daily and seasonal variations in deposit. An examination of the graphs and tables reproduced in the book shows clearly the social habits of the community, the lateness of rising on Sundays, the effects of high wind, rain, and snow, etc. The differences in deposits between the factory towns and residential or suburban districts in which observations were taken, are also clearly shown. This is followed by an analysis of the results in Rochdale with the automatic filter.

Smoke and Rainfall.

Dr. Ashworth suggests that the emission of solid particles and hot gases into the atmosphere will have an influence upon rainfall. "In a manufacturing town, such as Rochdale, with a large number of factories burning large quantities of coal, to the amount of 500 to 1,000 tons a day, it is probable that the finer and lighter matter ejected into the air by the draught up the chimneys will supply an abundance of the nuclei and hygroscopic particles which promote the formation of rain, added to which there will be the loading of the atmosphere by the water vapour which accompanies combustion and which tends to increase raindrops and rainfall."

If this the case it will be likely that there will be a lower rainfall on Sundays, when factories and mills are closed, than on weekdays. The rainfall records of Rochdale were therefore examined and it was found that over a ten year period, 1918-27, the Sunday rainfall was 13% less than the daily average for the other six days of the week.

At Stonyhurst, however, situated in a rural district in Lancashire, but with geographical and meteorological similarities to Rochdale, it was found that the Sunday rainfall deficiency was only 6%.

An examination of the 30 year period, 1898-1927, also shows that Sunday was the day of least rainfall in Rochdale, the deficiency being 6%.

A self-recording rain gauge, giving the hourly fall, has only been in use in Rochdale for two years, but during that period it is again shown that there are less hours of rain on Sunday than on weekdays, even though the night rainfall for Sundays is greater than the weekday average night rainfall. "Thus on Sundays

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at Rochdale there is a distribution of the hours of rainfall, over the 24 hours, like Stonyhurst and other west coast stations, but the weekday distribution suggests that the normal course of events has been disturbed so as to make the hours of rainfall more in the day than the night. This is what would be expected if the active discharge from mill chimneys is capable of influencing rainfall.

It seems likely, therefore, that the smoke particles and hot gases have a definite effect upon the rainfall.

Such a result would also be expected from the dust caused by quarrying, and the theory is supported by an examination of the rainfall records of Llanfairfechan. This town lies under the shadow of Penmaenmawr Head, on which up to a height of 1,500 feet blasting and quarrying go on vigorously during the working days of the week. The average rainfall per day of the week over a period of 11 years is 5.60 inches, and for Sunday alone—the day on which there is no quarrying—it is 4.93 inches.

The Influences of Pollution on Light.

The author examines three principal methods of measuring the intensity of light and of ultra-violet radiation. These are

(*a*) The potassium iodide method, in which iodine is liberated by the action of light from an acid solution of potassium, and is measured by titration with sodium thiosulphate.

(*b*) The methylene blue method, in which the extent of bleaching by light of a solution of methylene blue is measured by comparison with a set of standards.

(*c*) The photographic method, in which ultra-violet radiation is progressively obstructed by screens until it ceases to effect any change upon sensitized paper.

The last method is extremely simple to operate and requires no chemicals or laboratory equipment. It has been developed by Dr. Ashworth himself, and observations have been taken for the last three years at various centres, including the Manchester offices of the National Smoke Abatement Society.

The results that have been obtained by one or other of these methods show conclusively that solar radiation is seriously impeded by the smoke pall.

Observations in Manchester, for instance, by the potassium iodide method, show that if the light received at the suburban station is taken at 100, the light received in the city is less, as follows :—

Timperley (7 miles S.W.)	100
City Centre	68.6
Monsall (Outer N.E.)	52.8
Holt Town (Inner N.E.)	39.1

These figures are the average for eight years observations.

Park Square, in the centre of Leeds, receives only 83% of the light received at Headingley, 2½ miles away, for the whole year ; and only 74% for the winter months.

Dr. Ashworth's analyses of the figures he has collected show that in industrial towns the average intensity of light is appreciably higher on Sundays than on weekdays.

There are five useful appendices to the book, including observations on the deposit in Cheltenham, a residential town, a survey of atmospheric pollution in Rochdale, and an interesting comparison of the hourly deposit with electrical power output. An extract from an article by the airman Colonel the Master of Sempill is also given, in which the writer states that he has observed smoke over Manchester, Leeds, Huddersfield, Sheffield, etc., rising to a height of 6,000 feet, and in some cases to 8,500 feet.

We urge our readers to obtain this book ; it will become indispensable to all who are in any way concerned with the study of atmospheric pollution.

The Evidence

In its causes, effects, and remedies, the coal smoke problem is such a vast one, and is divisible into such a variety of separate subjects, that it is frequently difficult to bring together for any particular purpose the most useful and telling statistics and material facts that are available to illustrate any specific aspect. If, for instance, in a lecture it is desired to point out that smoke fog increases the respiratory diseases death rate, the statement is of little value unless it is backed up by evidence in the form of official statistics. The same applied to every other question of fact that enters into the case for smoke abatement : it must be supported by material and statistical illustrations.

There is no lack of such evidence and of illustrations of every kind, ranging from the most official and most scientific to those that compel attention because they are amusing or strange. Much has been published in the many text-books, in the Handbook, and in the pages of this *Journal*, but as a rule this material is not available for complete and rapid reference. It has therefore been thought that it will be of interest to all readers, and of direct value to those who speak or write, to collect and publish in the *Journal* a series of classified statistics and actual illustrations.

The large collection of books, papers, and pamphlets, in the Society's library are being examined for this material, and, beginning in the next issue, it will be published under classified headings according to subject. In addition to material facts and figures there will also be included, in the appropriate sections, quotations from authoritative reports, speakers, and writers, that can also be used to strengthen the case.

Readers are asked to help in this compilation by forwarding for inclusion any new material that will be of value but which is not generally known or available.

The series will be entitled " The Evidence."

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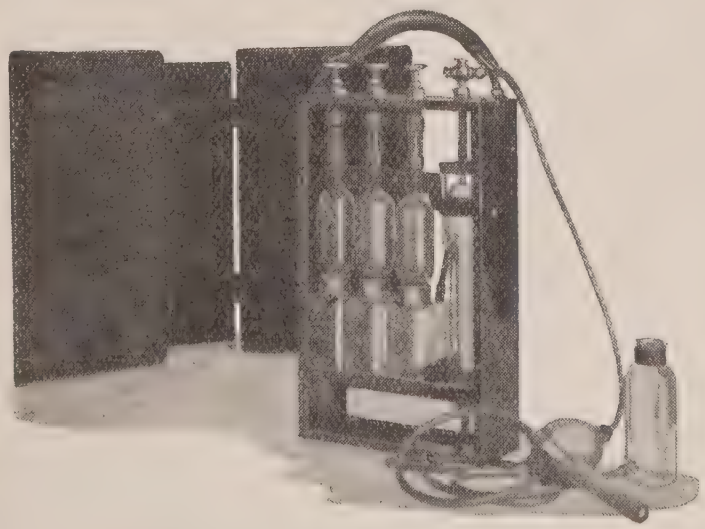

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Open Grate Coke

The production and use of smokeless solid fuels for domestic purposes continues to be a subject of discussion and interest among the technical bodies that are best qualified to consider it. The possibilities of a vast expansion in the use of such fuels has been visualized and the question is being considered fully and seriously from all angles.

During the last month or two there have been three important papers on the subject; one by Dr. E. W. Smith at a joint meeting of the Manchester District Association of Gas Engineers and the North-Western Section of the Institute of Fuel; one by Dr. G. E. Foxwell and Mr. John Roberts at Nottingham to the members of the Institute of Fuel and the Society of Chemical Industry; and the third by Mr. H. O. H. Cerckel, to the Midland Section of the Coke Oven Managers' Association.

We are indebted to Dr. Foxwell and Mr. Roberts for introducing the useful term, "open-grate coke," which they define as signifying "any free-buring coke suitable for use in the open fire-grate, as distinguished from the qualities of solid smokeless fuel now produced at coke ovens and gasworks, which are generally only suitable for boilers and other grates where there exists more draught than is usual in the open grate.

Mr. Cerckel dealt with the production of coke for domestic purposes from coke-ovens. Dr. Smith in his address considered the production of domestic fuel at the gasworks and by low-temperature carbonization, and paid particular and salutary attention to the economics of coal carbonization. Dr. Foxwell and Mr. Roberts reviewed the qualities that are essential in a successful open-grate coke and examined the factors that are required to attain them. The paper shows a thorough grasp of the problems that have to be solved in order to produce fuels that will be acceptable to the ordinary householder.

A Proposal to the Society.

Of particular interest to the readers of this *Journal* is a proposal made by Dr. Foxwell and Mr. Roberts. They point out that even now, in the early stages of production of these fuels, there is considerable confusion, and that in the future this confusion is likely to grow.

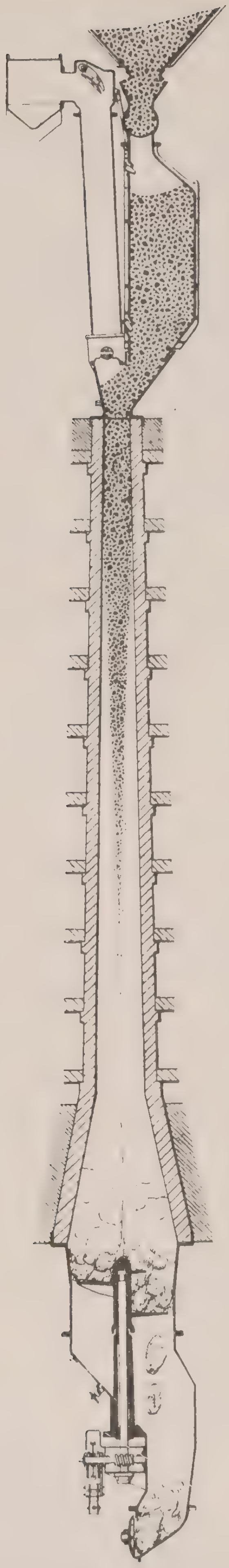
"We range over a miscellaneous mass of materials," state the authors, "having divergent characteristics, and containing anything between 1 per cent. or 2 per cent. of volatile matter and 20 per cent. Some are badly contaminated with ash, others are made from well cleaned coals. Some are dense, others are of an open structure. Some are hard, others are friable. Some are wet, others are dry. There is already a confusion of products; in the future, the confusion is likely to become worse. Hundreds of processes have been invented for making open-grate coke; how many will ultimately achieve some measure of success we do not know, but there may be dozens. Every one of these processes, and perhaps every colliery employing each one, will—according to present conditions—produce its own particular product, that will be given a name and put on the market under that name. Each one must be advertised, and must be sold, in a probably mutually destructive competition with its neighbours, by a great sales organization employing ultimately all the resources of modern salesmanship. The cost must be enormous, and that cost, added on to the price the consumer has to pay, will be a corresponding handicap to the cause of smoke abatement."

A Marketing Organization.

It is suggested that this confusion can be avoided in one rational manner—a combined marketing organization. "The form that such an organization could take can be seen from other industries or other products. We mention particularly the manner in which the British Commercial Gas Association assists the whole of the gas industry. As a yet more intimate example there is the Sulphate of Ammonia Federation and the National Benzol Company. The advantages of one national advertising campaign covering the whole country and the export market as well are great. At present, the manufacture of open-grate coke is in its infancy; the organization should be easily set into being, if only because there is so much pioneering work to be done. Could not the National Smoke Abatement Society start the movement?"

It has been considered by the Executive Committee that in view of such a direct proposal to the Society the question should be fully debated at an early opportunity. It has been agreed that the customary summer meeting of the Society in London should this year take the form of a whole-day conference on smokeless domestic fuels. It is some time since the subject has been considered by the Society, and it is felt that it will be valuable, in view of the present interest and developments, to devote a meeting to a detailed discussion. There will then be the opportunity to determine whether the Society can take any action on the lines suggested by Dr. Foxwell and Mr. John Roberts. Details of the Conference, which will be of more than usual value, will be issued in due course.

Our Solution of the Smoke Problem....



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The Coal Utilisation Council and Smoke Abatement

By H. L. PIRIE, M.I.Mech.E.

Technical Department, Coal Utilisation Council
and
Hon. Technical Adviser on Steam Raising to the Society.

There is, I know, an impression in the minds of some members of the National Smoke Abatement Society that the aims and objects of the Coal Utilisation Council are more or less directly opposed to those of the Society itself. I do not believe this to be the fact, and I hope that this article may convince my fellow-members that it is not.

The object of the Coal Utilisation Council is to increase the consumption of British coal. But I want to emphasise that it is a *Utilisation* Council. Its purpose is not merely to persuade the public to " burn more coal " but to " waste less coal." There is nothing contrary to the ideals of the N.S.A.S. in that surely !

The N.S.A.S. aims at reducing the amount of smoke that is emitted from the chimneys of industrial plants and from dwelling houses. But in one of his very first public speeches, after his appointment as Director of the Coal Utilisation Council, Mr. W. R. Gordon said that it was the intention of the Council to disseminate information " on such important problems as appliances for securing smoke elimination and fuel economy." And he added that the Council fully appreciated the importance of recommending an applicance that " burns coal smokelessly, and also in an economic manner ; for only thus can we hope to compete with foreign fuel, which admittedly has advantages over old-fashioned methods for the burning of coal."

" Bad Propaganda."

On this occasion Mr. Gordon was obviously referring mainly to central-heating plants, but in the Coal Utilisation Council's booklet, " Survey and Recommendations," it is proposed that " since smoke is bad propaganda and one of the greatest enemies of the industry, the Coal Utilisation sponsor a competition with a substantial prize, for the most effective simple appliance which could readily be fitted to a large proportion of existing domestic grates and enable them to burn bituminous coal with the least possible emission of smoke." That is an enterprise in which the Council will, I am sure, have the best wishes of the N.S.A.S.

Perhaps I had better make it plain, for the benefit of those who may not be aware of the origin of the Coal Utilisation Council, that it was formed by the joint action of all sections of the trade—coalowners, coal distributors, and coal exporters. The first thing it did was to undertake a comprehensive survey of the market, an investigation into the fuel requirements of the public and of the methods by which the coal trade met those requirements. Then it set up a Technical Department, whose principal duty was to examine appliances for the better utilisation of coal and advise the Council, and also consumers and distributors of coal, as to their suitability for specific purposes. For it had been discovered in the course of the survey that in the past comparisons had far too often been made between coal burned in old-fashioned and inefficient grates, stoves, furnaces, etc., and the most modern appliances designed to burn some other kind of fuel.

Another point that emerged from the investigation was the abiding affection of the ordinary man and woman for the open fire. There is no question about it, the open fire burning solid fuel is still regarded by the vast majority of the people as more comfortable, more cheerful, giving better ventilation, and being much cheaper than any alternative for living rooms. Now the view of the Coal Utilisation Council is that the instinct of the public in favour of the coal fire is sound, although it welcomes also the increasing use of stoves (either closed or those that can be opened at will) using anthracite, coal or other solid fuels. It is convinced that any attempt to limit by regulation the householder's choice of fuel would be both unwise and unfair to the poorer sections of the community, and would be bitterly resented. But it believes also that all the benefits and comfort of the coal fire may be retained and smoke at the same time much reduced, either by the extension of the use of smokeless fuels, by further improvements in the design of appliances, or by the application of some device to existing grates that will render the burning of bituminous coal practically smokeless.

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Modern Appliances.

I notice a most welcome likeness between the aspirations of the Coal Utilisation Council and some of the recommendations contained in the memorandum on Housing and Smoke Abatement issued by the N.S.A.S. in December, 1933. For instance, " it is hoped (by the Society) that where kitchen ranges are installed they shall be of the modern type that is more efficient and economical in fuel consumption, and that grates should be so constructed that they will allow smokeless fuels to be used with satisfaction . . . . It is suggested that the installation of independent domestic boilers, using coke or anthracite, or combined boiler-cookers, should be considered more than appears to have been the case in the past." Those words might have been taken out of the Coal Utilisation Council's new folder on " How to use Coal Wisely in your Home," a copy of which I should like to feel was in the hands of every member of the N.S.A.S. Then again, " the storage accommodation for solid fuels is, in many recently erected houses, very limited even for coal and is even more inadequate for the bulkier smokeless fuels . . more adequate storage room is therefore to be desired as a factor facilitating the use of these fuels." And so say all of us !

I am not going to pretend that the Council subscribes to all the statements of the more enthusiastic supporters of the N.S.A.S. It is, for example, often maintained that the domestic chimney is the chief offender in the matter of the pollution of the atmosphere. And yet I find Dr. J. R. Ashworth writing in his book on " Smoke and the Atmosphere " that throughout the seven years ending 1932 a typical industrial district of Manchester had only half the intensity of light that was enjoyed by a south-western suburb a few miles distant. I suggest that this is really evidence for the defence of the domestic fire, since I do not suppose it would be argued that there are more of these in the industrial district than in the suburb. Nor are all the fuels usually regarded as smokeless actually so in practice. Oil-fired central-heating plants, for instance, can be seen at certain times of the day belching forth volumes of smoke that would " black out " any factory chimney ; and this smoke, because of its origin, is far more damaging to textiles and other fabrics than the smoke from coal fires.

Coal v. Oil.

Last year the Coal Utilisation Council published a Bulletin entitled " Coal versus Oil." It deals with the utilisation of coal and, incidentally, contains some remarkable information on the reasons that have induced numerous hospitals, hotels, flat-buildings, factories and industrial undertakings of all kinds to convert from oil to solid fuel. It gives a description of modern methods of using coal with mechanical stokers having automatic control, many of which have been designed to overcome particular combustion defects. Their introduction in the plants described in the Bulletin has greatly reduced or entirely eliminated the emission of smoke, and members of the N.S.A.S. could help the work of the Coal Utilisation Council by transmitting to the Technical Department early information of consumers who are considering the installation of new plants or modernizing their existing equipment. Assistance would be willingly and quickly given wherever it is asked, and I think we shall all be agreed upon the desirability of every fuel plant being as up-to-date and efficient as it is possible to make it.

It will be readily understood that the work of the Council calls for the co-operation of makers of domestic as well as of industrial appliances. To further this co-operation action was initiated by the Coal Utilisation Council for the formation of an Association of Coal-burning Appliance Makers. Support was promptly forthcoming, and the Association has been duly formed with the objects of assisting the better and more extended use of coal, and of promoting research and other scientific work in connection with the consumption of solid fuel.

Value for Money.

The Coal Utilisation Council is also proposing to arrange lectures, both for members of the public and for coal salesmen, on the combustion of coal and the best methods of utilising it in order to avoid waste and get full value for the money spent on fuel. It is unfortunately true that knowledge about the scientific way of firing coal into a furnace, and even of handling coal in a domestic grate, is nothing like as general as it should be, and inefficient firing and handling inevitably means waste—and smoke.

Four Area Combustion Engineers have been appointed, with head-quarters in Glasgow, Leeds, Birmingham, and London respectively. Their duties will consist of keeping in touch with Local Authorities and local developments through architects, borough surveyors, heating engineers, medical officers of health, and all who are concerned, directly or indirectly, with heat and power. They will be available to advise on existing industrial plant or domestic appliances or upon contemplated changes therein, and it is hoped that the fullest advantage will be taken of their services.

In conclusion I would repeat that the ideal of the Coal Utilisation Council is a Britain in which everyone uses coal or one of its derivatives, but nobody wastes it ; and smoke is a form of waste, since it means that carbon which might have been turned into heat has been allowed to escape. Frankly we do not believe in the compulsion of the domestic consumer in this matter ; but we do believe in education, and we propose to do our utmost to contribute towards it.

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News and Views

The Problem in Belgium.

In the review of Mr. Henry Obermeyer's "Stop that Smoke!" it is stated that "it is some time since a full-sized text-book on the subject as a whole has been published." But now, following upon the heels of the important American work comes a close and careful study of the problem from Liège. It is "Les Problèmes de Pollution de l'Atmosphère" and is by Professor G. Batta, Professor J. Firket, and M. E. Leclerc, of the University of Liège. (Bibliothèque Scientifique Belge, Georges Thone, Editeur, Liège). This exhaustive scientific study has been inspired, of course, by the tragic fog that was experienced in the Meuse Valley in the neighbourhood of Liège, and it will be reviewed at length in the next issue of the *Journal*.

Smoke Nuisances from Road Vehicles.

Mr. Edward Hillman, of Hillman's Saloon Coaches, Ltd., lost his appeal at the Essex Quarter Sessions on January 12th, against a conviction by the Romford Justices under the Motor Vehicles (Construction and Uses) Regulations, 1931.

For the Romford Justices it was said that on October 21st a Hillman coach was seen to emit a dense vapour and a strong smell, at Romford. Evidence was given by Police constables who said that smoke came from the exhaust pipe for four or five minutes, and the driver told them that the smoke was due to paraffin oil used in the engine.

Mr. P. B. Showan, who appeared for the appellant, said there was no case to answer. He contended that the smoke was not due to the construction of the vehicle and was caused by the kerosene used. He also submitted that the changes could not be brought under the same section of the Act.

For the appellants evidence was given that the coach had been passed by Scotland Yard authorities, and the driver noticed nothing unusual about the emission of smoke.

Upminster Services Ltd., appealed unsuccessfully at the City Quarter Sessions at the Guildhall, on Monday, January 8th, against fines of 20s. on each of two summonses.

These alleged that they caused a stage motor coach to be driven on the road emitting smoke which could have been avoided, and that they failed to notify an alteration in the structure of a public service vehicle.

When the case was heard at the Mansion House it was stated that the company had been using paraffin for the engine of the coach, which was started on petrol from a small separate tank, the fitting of which had not been notified.

The Smoke of New York.

"Fewer than twenty years ago visitors were profuse in their praise of the year-round quality of New York air. Dating from about the period of the armistice the quality of the city's air supply began to change.

"To-day New York's combination of fuels, appliances, and combustion processes constitutes the most compact jumble of that sort possible to find anywhere. A recent report of the Society for Testing Materials states that its tests have revealed the air of New York to be 'industrial' in type and to rank in corrosive properties with Pittsburgh and other distinctively industrial cities.

"This change for the worse is attracting the serious attention of physical chemists, architects and engineering authorities, as well as causing perturbation on the part of physicians. Determination by Dr. E. E. Free lead him to say the pollution of to-day is almost double what it was some ten years ago."

Mr. H. B. Mellor, in the American Coal Trade Journal

The Vested Interest in Smoke Observations.

Mr. James Law, Chief Smoke Inspector of the Sheffield, Rotherham, and District Smoke Abatement Committee, gave an address to the Manchester and District Regional Smoke Abatement Committee on November 30th last, on the subject of Sheffield's experience in smoke prevention. In the course of his address he explained how the "vested interest" difficulty was overcome in the case of his committee. "The area is reviewed and each factory is given a number, the whole area being divided into four districts, each containing about 300 factories. It was found impracticable to number each chimney, there being about 3,885 chimneys in the area. When reports are made to Committee, the number and designation of the chimney only are presented, no names are shown. This rules out to a considerable extent the 'Vested Interest' Difficulty of the small district."

Smoke and Bronchitis.

In the December report of Dr. James Bennet (medical officer) to the Warrington Rural District Council, it was stated that six of the 10 deaths were due to bronchitis, which cases were, in all probability, accelerated by the persistent fogs in a dirty, smoke-laden atmosphere.

Classes for Boilermen.

New courses of instruction for boilermen have been started in Liverpool and in Warrington. At a preliminary meeting held in Warrington a resolution was passed that might be taken as a model for future developments of a similar nature in other towns :—

> "That this meeting of Warrington Manufacturers approves the suggestion for the inauguration of a course of lectures for firemen and others on 'Fuel Economy and Smoke Abatement.'
>
> "That it be recommended that, to encourage the men to attend, the employers should, where possible, pay the fee of 7s. 6d. for the course."

Petrol Fumes and Public Health.

On December 11th, in the House of Commons, Lieutenant-Colonel Headlam, Parliamentary Secretary to the Ministry of Transport, told Mr. McEntee that the possible effect of petrol fumes on the drivers and conductors of motor vehicles was considered incidentally by the Departmental Committee appointed by the Home Secretary to einquire into industrial diseases. He did not think there was sufficient evidence of injury to the health of drivers or of other road users from exhaust fumes to justify legislative action. Defects in exhaust pipes were looked for by the examiners in the examination of omnibuses and motor coaches. Similar defects in good vehicles would come under the observation of examiners when occasion arose for the inspection of such vehicles under the provisions of the Road and Rail Traffic, 1933.

Mr. McEntee asked if any regular research was taking place into the effect of these fumes on the health of the public, and whether the Minister had seen a statement issued by a number of highly qualified medical men that the fumes had a serious effect. Lieut.-Colonel Headlam said the matter was under close observation. He had seen some suggestions by doctors, but the latter were varied in their opinions.

Housing and Smoke Abatement

The Resolutions of Housing and Smoke Abatement passed at the Sheffield Conference and published in the last issue of the *Journal*, have been circulated to 1,200 Housing Authorities throughout the country, and to them has been attached an explanatory Memorandum. Extracts from this Memorandum are as follows :

Smoke and Slum Conditions.

The dictionary definition of the word "slum" is "a dirty back street or court or alley in a city." The connection between slums and dirt is obvious, and although the dirt is intensified by poverty and overcrowding, its origin is principally the smoke deposit which falls most heavily in densely crowded areas. One of the essentials of replanning and slum clearance is smoke abatement, and both in the replanning and rebuilding of cleared areas and in the development of new housing estates it is desirable that there should be the minimum smoke emission possible from the houses or flats. The campaign against smoke is an essential part of the campaign against slums and the amenity value of a smokeless atmosphere and its effects upon health and cleanliness are considerable. The question of property maintenance and repair, which operates during the whole period of existence of the property, is an important factor in costs, and there is no doubt that it is considerably increased by the dirt and corrosive action of coal smoke deposit . . .

Further, public opinion is now recognizing that the smoke nuisance, on hygienic, economic, and amenity grounds, must be abolished as quickly as possible, and in any case it is inconceivable that the present deplorable conditions will be permitted to continue unchecked indefinitely. Therefore the erection of houses in the near future in which no provision is made for a complete use of smokeless methods, including the burning of solid smokeless fuels, must be regarded as a short-sighted and impeding policy.

The degradation of the atmosphere in suburban districts as a result of housing development is already marked, and it is strongly urged that the greatest possible degree of smokelessness in new estates should be attained to prevent an extension of such degradation.

It is not considered necessary in this Memorandum to give a detailed account of the ways in which smoke affects health and social well-being, for the facts are now recognized and acknowledged by all informed opinion. One brief quotation may, however, be made, which shows how authoritative opinion links up congested conditions and atmospheric pollution as twin causes of respiratory diseases mortality. Mr. Neville Chamberlain, then Minister of Health, said in the House on Commons on June 28th, 1923 :

> "I should not be surprised if, owing to the great attention which has been given to certain complaints, some Hon. Members thought that the most fatal diseases were tuberculosis and cancer. That is very far from being the case. Easily the first in their fatal effects are those diseases which are classed as respiratory diseases—pneumonia, bronchitis, and diseases of that kind—and I am afraid that we must attribute the very high mortality which we suffer from those diseases to the congested conditions and polluted atmosphere which are to be found in our large towns."

Methods and Accommodation.

The Memorandum then proceeds to urge the more extensive use of gas and electricity and the installation of modern types of kitchen range and open fires that will allow smokeless fuels to be used with satisfaction. Owing to the greater bulk of smokeless fuels it is urged that greater accommodation space should be provided in new houses. It is pointed out that while the supplies of smokeless solid fuels are yet limited, their production and use is rapidly growing, and that therefore Housing Authorities should encourage their use by the simple and inexpensive means that are at their disposal. "The elimination of domestic smoke by the complete abolition of raw coal is only a matter of time, and it is considered that Housing Authorities have a reasonable opportunity for hastening the reform."

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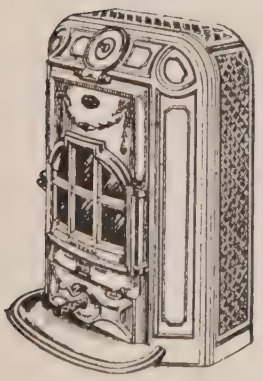

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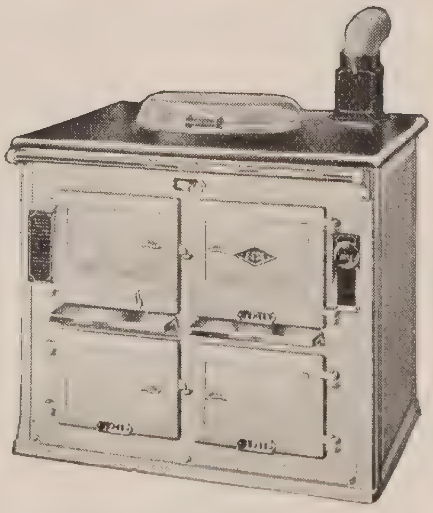

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The Journal of the National Smoke Abatement Society

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The Journal is open for free discussion of all aspects of the smoke problem, and the opinions expressed in contributed articles are not necessarily the same as the views of the Society. Quotations and abstraction of matter appearing in the Journal is welcomed, provided the usual acknowledgements are made.

COMMENTARY.

THE Sixth Annual Conference will be held this year in Glasgow. This will be the first time that the Society or its predecessors have met in Scotland, for the unbroken activities and influence of the Scottish Branch have rendered any southern help quite unnecessary. The Conference will, this year, be extended by one day, and will begin with a Civic Reception on Thursday evening, September 27th. The Annual General Meeting will take place on Friday morning, and will be followed by the first two sessions of the Conference, one of which will be under the auspices of the Scottish Branch, during the remainder of the morning and the afternoon. A meeting on Saturday morning will be followed by a tour to the Trossachs or some other of Scotland's many places of scenic interest. The Scottish Branch usually holds its own Annual Conference in May, but this year it is being postponed and combined with that of the National Society. A larger meeting than usual is thus to be expected, and members and delegates are asked to make a note of the date now—September 27th.

Before the Glasgow Conference there is to be the summer meeting in London, which, as mentioned in the last issue of the *Journal*, will be a whole-day conference on smokeless open-grate fuels. It will take the form of a symposium in which eight speakers will read short introductory contributions on the different smokeless open-grate fuels and the important questions concerning them. One of the eight will be by a lady, who will speak upon the subject from the point of view of the housewife. The symposium and discussion should form a valuable contribution to what is, at the moment, the most pressing problem of smoke prevention. The facts are simple : there are millions of open-grates in use in the country, and most of them will continue to be used for many decades to come. The only way of preventing the smoke that they are at present emitting is to use a smokeless solid fuel in them in place of the present raw bituminous coal. New types of grate, gas and electric fires, or central heating will not touch this difficult core of the domestic smoke problem. Only an adequate supply of a fuel that is satisfactory in both properties and price can hope to succeed. The position today is very interesting and hopeful, and the meeting on June 8th should prove to be of material usefulness.

Many readers will have seen the letter from our President, Dr. H. A. Des Voeux, which appeared in a prominent position in "The Times" on March 2nd. It was a valuable and timely comment upon the fog and dirty conditions experienced this winter as a result of abnormally extended anticyclonic conditions. Dr. Des Voeux points out that although the number of smoke fogs in London has been reduced since the end of the last century, and that although the Society has done much to improve conditions, a further advance cannot be made except through "the consciences of the public at large." "Until every citizen recognizes that he or she is the cause of the dirty fogs nothing really adequate and valuable in the progress towards our objective 'clean air,' can come to pass." The letter stresses the important point that not only should the fog of the towns be as clean and as harmless as that of the country, but that "in a city like London fog ought to be less frequent than in the outer districts, owing to the slightly higher temperature in the lower air produced by the enormous number of heating appliances required to heat the buildings, which even now tends to lift the smoke-laden fog, heavy as it is, above the level ground, a condition seldom seen outside."

Two or three weeks later Dr. Des Voeux, in speaking to the London Society, said that the only interest his letter had aroused was, apparently, in his use of the word "smog" for smoke-fog. Controversy was aroused about the philological correctness of the word—which was dubbed a "portmantologism"—but none at all about the thing itself. That is typical of the attitude taken by people who possess learning but not understanding. They debate hotly among themselves whether smog is a good word, but are indifferent to whether smog is a bad thing. At the same time discussion about smog is better than nothing, and the association of smoke with fog is perhaps the first step towards a realization of the desirability of fog without smoke. The British Public is, as all reformers and publicists know, a curiously irrational organism that becomes stimulated in unexpected ways. Smog may be stirring its imagination more than smoke-fog has hitherto been recognized as a self-made and avoidable visitation.

The smoke abatement movement in the United States has received some useful publicity from an article on "Our Soiled Cities" by W. B. Courtney in *Collier's Weekly*. There is always something for us to learn from the work of our American friends, and Mr. Courtney's vividly written article is stimulating to read. Particularly striking is the metaphor of the huge black umbrellas of smoke which the cities put up over themselves, and the apt description of smoke turning "our lungs into a couple of waterproof socks." The term "false horizon" seems a new one—"When you fly across the United States do not think that you will see only fair and smiling land, with towns along the route marked by white houses and steeples bright in the sun. Indeed, a day of wide visibility even over open country—even when skies are clear overhead—is so rare that pilots talk about it. Usually there is a 'false' horizon ten degrees or so above the true horizon. It is the rim of the dust and smoke blanket which circulating air spreads over the country. Usually, too, there is a haze which blurs everything at a distance of several miles from your cockpit into a vague bowl that flies along with you."

Atmospheric Pollution

The Report of Observations for the Year 1932-33.

The 19th Report on the Investigations of Atmospheric Pollution, Department of Scientific and Industrial Research (H.M. Stationery Office, 5/-) shows once again the value of these important researches and observations. The income available for the work for the year covered by the Report was £758, and there were in operation 86 deposit gauges, 10 automatic filters, and ten sets of apparatus for determining sulphur gases in the air.

In his report as Chairman of the Standing Conference of Co-operating Bodies, Dr. Des Voeux mentions that the question of fumes from motor vehicles has been considered in view of the possibility of danger from carbon monoxide becoming concentrated in city streets. It was considered whether methods should be devised for the routine determination of the amount of carbon monoxide in the air in urban areas, and decided that, while this was unnecessary, it might be well for local authorities to consider the advisability of making occasional determinations to learn whether, under abnormal conditions, such as foggy weather, concentrations of carbon monoxide at busy traffic centres are greater than are generally supposed. The Conference wishes to commend to local authorities the suggestions of the Committee because there is a need for more extensive data than are at present available to determine whether there is any basis for the anxiety that is sometimes expressed.

The Chairman's Report also states : " The importance of systematic investigation of atmospheric pollution is now widely recognized. Public opinion is awakening to the fact that the smoke pall spread over our urban areas is not an act of nature to be tolerated as inevitable, but is the result of unscientific use of coal. Its removal is merely a question of the exercise of national forethought and will."

The Report of Dr. Simpson, Chairman of the Research Committee, gives an account of the experimental work that is being done to devise an instrument for the classification of smoke emissions. The work is still incomplete but " it is hoped that it will be possible ultimately to make the instrument the basis of rough measurements of the relative total amounts of pollution emitted, in a given period, by various chimneys."

The Deposits.

The table showing the comparison of results with the general average once again indicates an improvement. 39 stations show a reduction of total solids and 12 an increase. Tar and sulphates, two important constituents, show reductions in 26 and 35 cases, and increases in 16 and 11 cases, respectively. It may be noted that tar, which is almost entirely derived from domestic smoke, shows a smaller number of reductions, and a greater number of increases, than any other constituent of the deposits.

In comparison with the general average, the reduction in the several constituents for the whole group of stations, expressed as a percentage, is as follows :—

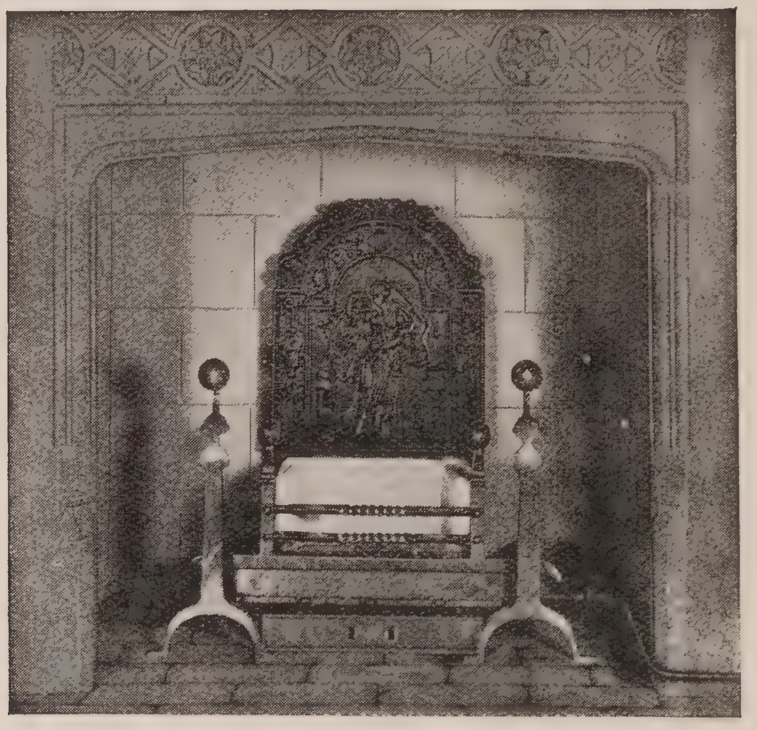
Insoluble Matter :		
Tar	14%	reduction
Carbonaceous, other than tar	13%	,,
Ash	8%	,,
Soluble Matter :		
Loss on Ignition	10%	,,
Ash	13%	,,
Total Solids	11%	,,

The Individual Deposits.

Space will permit only the reprinting of the total solids deposit for each of the stations. In the tables given in the Report the mean monthly deposit is given in both metric and English weights, but the deposit for the year is given only in metric figures. As, in spite of the superiority of the metric system for all classes of work, it is thought that deposits are usually considered in terms of tons per square mile per annum, the figures given in the Report have been converted to these units, and are as follows. The period is from April 1st, 1932, to March 31st, 1933.

London, Archbishops' Park	333
Finsbury Park	234
Golden Lane	345
Horseferry Road	329
Kew Observatory, " N "	115
Kew Observatory, " S "	135
Mount Street	293
Ravenscourt Park	474
South Kensington	193
Southwark Park	235
Victoria Park	209
Wandsworth Common	165
King Charles Street	285
Ashington, High Market	465
Birmingham, West Heath	193
Bourneville, Village	125
Works	153
Bradford, Central	401
North	116
Burnley, Queen's Park	253
Town Hall, No. 1	416
Cardiff	132
Castleford	308
Cheltenham	175
Dewsbury, Meadowcroft	231
Ravensthorpe	188
Whitley	119
Edinburgh, Bruntsfield House	172
Leith Links	173
Princes Street	325

The Smokeless, Economical "METRO" COKE FIRE



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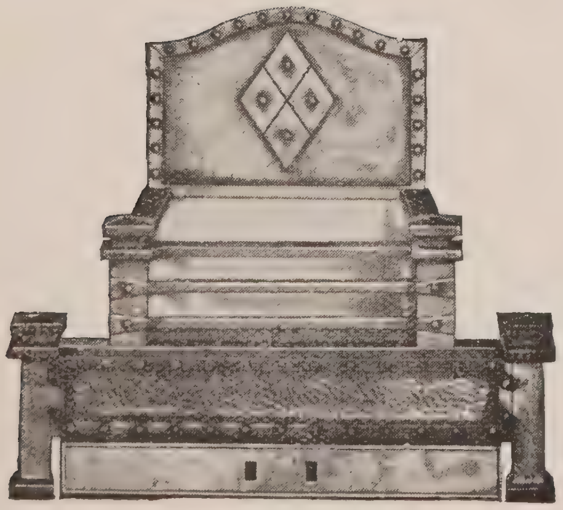

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Garston	144
Glasgow, Alexandra Park	246
Bellahouston Park	218
Blythswood Square	268
Botanic Gardens	293
Queen's Park	165
Richmond Park	234
Ruchill Park	208
Tollcross Park	235
Victoria Park	233
Gloucester	142
Halifax, Akroyd Park	159
Belle Vue Park	150
Infirmary	128
Wade Street	299
Kingston-upon-Hull, Central	336
Suburban	171
Leeds, Headingley	113
Hunslet	261
Park Square	341
Temple Newsam	89
York Road	269
Leicester, Milton Street	321
Town Hall	375
Western Park	97
Liverpool, Cambridge Street	310
Netherfield Road	600
Loughborough	301
Marple	108
Newcastle-upon-Tyne, Town Moor	209
Welbeck Reservoir	220
Westgate Road	269
Rochdale, Town Hall	197
Rothamsted	91
Rotherham, Oakwood Hall Sanatorium	145
Town Hall	379
St. Helens	389
Salford, Drinkwater Park	203
Ladywell Sanatorium	216
Peel Park	262
Sheffield, Attercliffe	281
Nether Green	145
Surrey Street	374
Southport, Bedford Road Park	121
Hesketh Park	113
Stoke-on-Trent, Leek Road	247
Wakefield, Clarence Park	102
W.R. Rivers Board	241
Walsall	258

It will be seen that the highest deposit recorded is from Netherfield Road, Liverpool, with 600 tons per square mile for the year, and that the lowest is Temple Newsam, near Leeds, with 89 tons per square mile.

It is, of course, impossible to compare the figures from different towns with a view to arriving at a knowledge of the relative cleanliness of their atmospheres. The position of the gauges is a principal factor, and, as there is no certainty of how the results obtained from one gauge or a group of gauges in one town really record the average degree of pollution, comparisons must be made with care.

Sulphur Measurement.

As acidic compounds of sulphur are the most destructive of all constituents of coal smoke the reports upon their measurement are of especial interest. Results are given of determinations by the volumetric method, and charts are reproduced of the "activity" of atmospheric sulphur by the lead peroxide method developed by the Building Research station. The differences between industrial and rural stations is shown most markedly, as is also the sharp rise during the winter months—showing the influence of domestic heating during the cold season. This difference between summer and winter is seen most clearly, of course, in the curves for London and the industrial towns, but is present also in the rural districts such as Garston and Rievaulx Abbey.

Smoke Abatement in Belgium

"Les Problèmes de pollution de l' Atmosphère."

BY CHARLES GANDY.

It is impossible in a short review to do justice to the wealth of scientific study and practical suggestion, which have been gathered into this most interesting book (Les Problèmes de Pollution de l'Atmosphère, Batta, Firket, and Lelerc; Bibliothèque Scientifique Belge, published by George Thone, Liège. pp. 455). The joint authors are all men of high distinction in Liège University, M. Batta as Professor of Industrial Chemistry, M. Firket as Professor of Pathological Anatomy and Medical Jurisprudence, and M. Leclerc, a Mining and Electrical Engineer, as Principal of the Industrial Chemical Labatory at the University. The two first were members of the Expert Commission appointed by the Belgian Courts to investigate and attempt to assign responsibility for the terrible tragedy of December, 1930, when sixty persons lost their lives, thousands were more or less seriously ill, and considerable damage was caused during a few days fog in the busy Meuse valley.

The celebrated hygienist, Professor Malvoz, who contributes a preface, explains how in sitting down to this task and seeking the necessary data the Commission soon realized what a very little is yet known of the effects on health of a contaminated atmosphere as compared with the knowledge we have acquired of the effects of a contaminated water supply. Numerous publications on the subject, especially those in English and German, were consulted, but much further experimental research had to be undertaken before a report could be made. That report as presented is set out in full and occupies some ninety pages of the present work.

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GAS COKE is smokeless, cheap & clean

"No other problem," says the authors, "gives a more striking example of the wide variety of technical and administrative skill required to cope with the great problems of public health than does the problem of atmospheric pollution." Certainly they have brought to their study a great diversity of scientific, medical and general knowledge, beginning with a careful and detailed study of the atmosphere and its constituents, and dealing not only with the more usual effects of smoke but with every other type of pollution of which the atmosphere would appear susceptible, with the exception, as they say, of that devised by humanity for the purposes of War.

The book proceeds with a detailed study of the effects so far known of various constituents of a polluted atmosphere on human health, on plant life, on metals, on buildings, etc. A chapter is devoted to a survey of the known scientific methods of combatting different forms of pollution from industrial and domestic sources, and a further very interesting chapter giving details of the law relating to atmospheric pollution as it exists in Germany, France, United States, England and Belgium. The authors deprecate any attack on this or that group of individuals, or any action which might hamper the legitimate requirements of industries concerned, but insist that public authorities with the aid of voluntary associations, should be responsible for the constant collection by qualified persons of data regarding the atmosphere of their neighbourhood, and the causes, extent, nature and consequences of its pollution, and for the preparation of maps and charts providing statistics on which a fuller study of the problem, as a whole, and the more practicable remedies available for its solution, may be based.

Co-ordination Required.

They suggest a closer co-ordination between the various health authorities, those responsible for factory inspection, and industrialists themselves, to ensure that the regulations imposed shall meet the requirements of the area affected. Upon the information thus gained authorities should proceed to approve and popularize the best systems for the heating of dwelling-houses, and recommend methods of smoke elimination in particular industries.

They cite the example of an industrial group in the Meuse Valley itself which, by intensive research undertaken since the disaster, has succeeded at comparatively small expense in a reorganization of its various chemical and metallurgical processes, and now besides having increased its manufactured output, recovers some seven tons daily of sulphur previously lost into the atmosphere. They suggest that other firms would, if properly encouraged, take similar action, and that it is the firms engaged in a particularly industry who are themselves best qualified to undertake such action. The present time, when production is generally below capacity, is they suggest particularly suitable for such research and improvement. They stress the value of the work which could be done in Belgium, as elsewhere, by unofficial associations. How soon, they ask in conclusion, shall we see the formation of a Belgian National Smoke Abatement Society?

Why Anthracite?

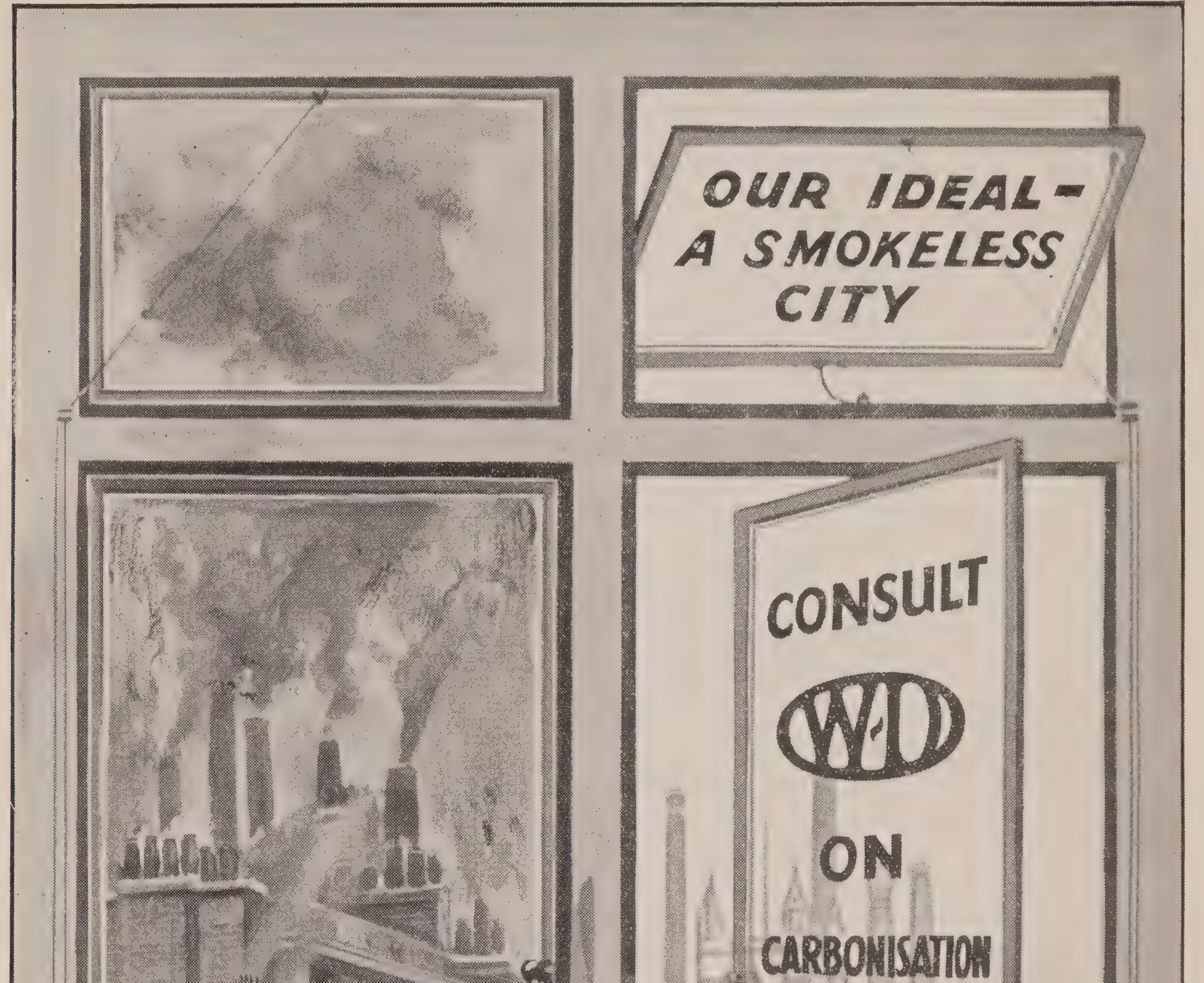
By A STOVE DEALER.

How can smoke abatement be expressed in terms of maximum fuel economy and efficiency? As a business man, that is a question I am bound to ask. And, with thirty years of enthusiasm behind me, I find the answer in anthracite. Call me biassed if you will, but at least let me explain.

When I first realized its enormous advantages, and introduced anthracite heating stoves in London, I sent a circular letter to a number of coal merchants asking their prices for the fuel delivered in one ton lots within four miles of their depots. As a result, wholesale dealers in London were inundated with enquiries from the coal merchants, who, at that time, knew practically nothing about anthracite and certainly had not appreciated its utility in the domestic and commercial fields.

Slowly since those days the virtues of anthracite have become known to a small section of the general public. I say "small" advisedly, for at a recent meeting attended by well educated men and women I suggested anthracite as the correct fuel for a certain appliance, and heard from all sides the remark, "Anthracite is far too expensive." That, I suppose, sums up the opinion of the vast majority of the British public, who are not yet aware that anthracite is Britain's most valuable mineral asset, and is amazingly cheap when properly used.

Merely to state the truth that anthracite is smokeless and burns slowly, does not impress the uninitiated. This is not enough to oust smoky coal in favour of its smokeless cousin, not to transfer affection from gas, electricity or oil. Fortunately, there is much more to be said for anthracite than that. Why is it that more than half the anthracite coal mined in this country is sent overseas? It is because anthracite is more fully appreciated in countries abroad where there is greater need for thrift. We have hitherto been shockingly wasteful in our methods of heating. We produce the



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finest anthracite in the world, and surely the time has come for us to make its advantages more fully understood by our own people.

High Efficiency.

I go so far as to claim that anthracite, when consumed in the wonderful modern appliances now available, provides the cheapest means of heating and cooking known. The highest possible thermal efficiency is combined with the social blessing of smokelessness and the domestic blessings of extreme cleanliness, labour-saving and healthy heat.

In the closed mica-fronted stoves designed for heating by slow combustion the centre of the appliance forms the reservoir for fuel, and in the lower portion the fire glows, and continues to glow, so long as fuel is fed once a day through the door in the top. The heat that is generated is made to pass round the body of the stove through narrow passages, radiating heat as it travels. Coke is certainly an alternative fuel, but the fire will not keep alight for 24 hours on end with one filling, as it will in the case of anthracite.

Anthracite has no caking tendency and has a very low volatile percentage. That means it gives off very little flame—it merely glows. The heat generated is therefore given off where the fuel is burning and from the narrow passages which encircle the stove and through which the hot products of combustion have to pass. This ensures that almost 90% of the heat value passes into the room through the mica front and the metal body of the stove.

The use of ordinary coal is out of the question in appliances of this nature, because soot would soon choke the narrow encircling flues. Soot, incidentally, is a non-conductor of heat. Ordinary coal, of course, will burn in a closed stove, but the narrow, heat radiating, encircling flues would have to be dispensed with. Tests have proved that the removal of those encircling flues almost doubles the cost of the fuel consumption.

In the new heat accumulator cookers, anthracite again gives the maximum efficiency. The heat is absorbed by heavy castings, which form the internal construction of these amazing cookers, and is given off into the utensils on the hot plate and in the ovens. Coke is a possible substitute, but its porous nature necessitates much more frequent stoking.

In the ordinary range where the top plate and ovens are heated normally by flame, which passes below the hot plate and round the oven, there must always be a considerable amount of waste heat passing into the chimney, but in the heat storage cookers, with their very small fire chambers, full of glowing coal, there is practically no waste heat passing into the chimney.

Further, the cost of anthracite compares favourably with any other type of fuel. 100,000 B.Th.U.s, for instance, are contained in about 7lbs., and at 60/- per ton the cost is 2¼d. One pennyworth of anthracite, in one of the new cookers, it is astonishing to discover, will boil as much as 360 pints of water. These figures should be used by those who wish to advocate the advantages of anthracite when explaining that it is not an expensive fuel.

Why is anthracite not more popular? My reply to this is quite simple—the public have not been told about its unique advantages.

One fine winter day, when the air was almost still, I stood on a tower on the northern fringe of the city of Glasgow. Looking outward, to the west, north, and east, over an expanse of three-fourths of a circle, I saw a beautiful country; undulating fields stretching out to snow-capped hills in the distance, all brilliant in the sunshine; not a cloud in the sky. In that flood of light were *health-giving and disease-curing rays.* Looking southward, below me I saw a sea of dense smoke-fog, through which nothing was visible; but here and there, reaching out above it, was the point of a spire or the crown of a tall chimney. Underneath the surface of that smoke-cloud, enveloped in it, were a million people, breathing and choking; their eyes smarting; the delicate membranes of their noses and throats irritated almost beyond endurance by the acid vapours, and the pungent oily-tar being drawn into their lungs; some of it to stay there and obstruct the free entrance of air into the vesicles. I knew that within a few days some would die—those most susceptible, the older and the very young—while many others would contract the beginning of some lasting disease—*From a recent paper by Councillor W. Brownhill Smith.*

Smoke Abatement Lectures at Rotherham.

The Rotherham College of Technology and Art has been holding, under the auspices of the Sheffield, Rotherham, and District Smoke Abatement Committee, a course of six lectures on Smoke. The lectures have been designed to interest all persons concerned with combustion and heating from an industrial point of view. The first lecture on "Smoke" was given by Mr. J. Law, the Chief Smoke Inspector of the Committee, with Mr. Arnold Marsh in the chair. The five following lectures were given by Dr. Heathcoat and Mr. Simmonds, of the College, and were entitled "Fuel," "Combustion," "Boilers," "Furnaces," and "Combustion Control." It is hoped that these introductory lectures will arouse interest enough to permit the arranging of a series of classes on the subject next winter. They have been well attended, largely by people who are directly concerned with the production of smoke, and whose interest is therefore valuable.

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The Coal Utilisation Council and Smoke Abatement.

To the Editor
The Journal.

SIR,

I have read with great interest the above article written by Mr. H. L. Pirie, M.I.Mech.E., and published in the current issue of the *Journal*. Whilst one must sympathize with Mr. Pirie in the difficult role he has undertaken, there are certain statements made in his apologia for the domestic use of bituminous coal which cannot be allowed to pass unchallenged.

It is quite true that the " ordinary man and woman " has an abiding affection for the open fire burning solid fuel, and so long as the solid fuel is not bituminous coal, no advocate of smoke abatement will regret the fact, although he will entirely disagree with the view expressed by the Coal Utilisation Council that the " instinct of the public in favour of the coal fire is sound."

I note that the said Council propose to offer a substantial prize for the most effective simple appliance which could readily be fitted to a large proportion of existing domestic grates and enable them to burn bituminous coal with the least possible emission of smoke. The last five words suggest that the Coal Utilisation Council know full well that *smokelessness* cannot be achieved by burning such fuel in an open grate. I would suggest that money spent in altering domestic grates so as to enable them to burn coke produced by high and low temperature carbonization of coal would produce much more satisfactory results. Indeed, many existing types of domestic grates are eminently suitable for the burning of such fuel. For many years I have burned gasworks coke in an ordinary well grate with entire success, and would further point out, with greater economy than burning coal.

Although it is admitted that oil-fired plants can produce " volumes of smoke " it is nevertheless a fact that given proper working conditions—correct atomization, feed, air supply, etc.—such fuel can be—and is—burned smokelessly. Oil, however, cannot be used in an open grate and is therefore not extensively used for domestic purposes in this country for reasons so ably stated by the Coal Utilisation Council.

In conclusion, may I suggest that, in its raw state, bituminous coal is not a suitable fuel to burn in an open grate but should rather be regarded as a product from which *actual* smokeless fuels can be obtained.

Yours, etc.,

JOHN W. BEAUMONT,
Chief Sanitary Inspector, County Borough of Halifax.

The New Regional Committees

Progress in West Lancashire and the North-East Coast.

THE NORTHUMBERLAND AND DURHAM COMMITTEE.

This Committee was formed in May, 1933, and the Executive Committee has met in October and February. All Local Authorities in the two counties are eligible to join, County Councils and County Boroughs appointing two representatives each to the Committee, and Municipal Boroughs, Urban District Councils, and Rural District Councils one representative each. The subscription is two guineas a year from each constituent authority.

Two sub-committees have been appointed, one to deal with legal, administrative, educational, and propaganda questions; the other is concerned with scientific and technical matters. The subjects at present being discussed by the sub-committees include (*a*) courses for stokers, (*b*) smoke from low-chimneyed brick-kilns, (*c*) burning pit-heaps, (*d*) grit from electric power stations—danger to eyes, and (*e*) lime dust from colliery chimneys.

At the meeting on February 27th, the legal aspects of the smoke nuisance were discussed by Mr. G. S. McIntire, Town Clerk of Sunderland and by Dr. A. Stuart Hebblethwaite, Medical Officer of Health for Sunderland. Dr. Hebblethwaite in his remarks urged the necessity for the appointment by the Regional Committee of a qualified full-time Smoke Inspector. This was strongly endorsed by Mrs. E. Kelly (Longbenton U.D.C.), and the Chairman (Alderman David Adams, J.P.) intimated that the question would be included for full discussion on the Agenda at the next meeting, when details with regard to the financial side of such an undertaking would be available.

Model Byelaws.

Councillor E. Gilbert, J.P. (Gosforth U.D.C.) suggested that the Committee might draft model byelaws for use throughout the area covered by the Regional Committee. The suggestion received strong support, and the Chairman intimated that it also would be included on the Agenda for the next meeting.

"Safety First"

Dr. J. T. Dunn, Public Analyst for Newcastle-upon-Tyne and Northumberland C.C., etc., read a most informative paper entitled "Some Facts and Data Concerning the Smoke Problem." Dr. Dunn emphasized the advantages of the use of smokeless fuel, with special regard to the domestic fire. This was endorsed by the Chairman, who further suggested that the Local Authorities represented might well give a lead by using smokeless fuel in their public buildings and works.

WEST LANCASHIRE AND CHESHIRE COMMITTEE.

A Conference of Local Authorities of South-West Lancashire and North Cheshire was held in Liverpool on the 10th April, 1933, at which it was decided to form a Regional Smoke Abatement Advisory Committee. Representatives of 21 local authorities attended and were invited to participate in this work. Of these the following 19 accepted, namely, the County Boroughs of Liverpool, Birkenhead, Bootle, Wallasey, Chester, St. Helens, Widnes, and Preston and the County of Lancashire. In addition, the Urban Districts of Bebington, Great Crosby, Huyton with Roby, Litherland, Neston, Ormskirk, Prescot, and Waterloo with Seaforth, and also the Rural Districts of Whiston and West Lancashire agreed to participate.

A Committee of 38 members was formed consisting of two representatives from each of the participating authorities. It held its first meeting in Liverpool on December 11th, 1933. It was agreed that the Committee should be known as the West Lancashire and Cheshire Regional Smoke Abatement Committee and should function as an Advisory Committee. Articles of Constitution were framed and Rules were made to govern the formation and working of an Executive Committee. An affiliation fee of £2 2s. 0d. annually was agreed upon in the case of the larger participating authorities and £1 1s. 0d. annually in the case of the smaller ones.

The Executive Committee was formed by the choice of 14 representatives from among the 19 participating authorities, provision being made so that authorities not directly represented during one year would be represented during the following year. This Committee held its first meeting on March 19th, 1934. The Honorary Secretary (Dr. W. M. Frazer) reported that success had followed the inauguration of a course of lectures on smoke abatement and fuel economy which had been arranged to take place at the University School of Hygiene in Liverpool. Twenty lectures had been designed to meet the requirements of those who proposed to obtain the Smoke Inspector's Certificate of the Royal Sanitary Institute and ten of these lectures were of a relatively simple and practical character in order to give appropriate instruction to works managers, engineers, leading stokers and others interested in fuel economy. Notice of these lectures was sent to all the principal local manufacturers as well as those in the neighbourhood of Liverpool and a gratifying response was the result. Of 119 students enrolled, 76 are taking the full course of 20 lectures. In several instances the fees for students had been paid by their employers.

Questionnaire to Authorities.

The principle decision of the Executive Committee at this meeting was the formulation of a questionnaire to be addressed to the 19 participating authorities. In the main this questionnaire will seek to obtain information relating to the existence or otherwise of a bye-law under the Public Health (Smoke Abatement) Act, 1926, difficulties arising out of the administration of such a bye-law, the existence or otherwise of a local Act of Parliament regulating smoke emission, details of staff engaged in the detection of smoke nuisances, types of industry prevailing, the use of smoke consumption devices and smokeless fuels and what steps, if any, are taken in respect of local propaganda. In due course this information will be collected and tabulated.

The Honorary Secretary of the West Lancashire and Cheshire Regional Smoke Abatement Committee is Dr. W. M. Frazer, Public Health Department, Municipal Annexe, Dale Street, Liverpool, 2.

Smoke and the National Economy

"Coal in the New Era."

On the grounds of health, amenity, and economy the case for smoke abatement is sufficiently strong to stand alone. It needs no support, as a case, from any external considerations. Its progress may be hastened, however, if the problem is looked upon as ancillary to one of the most momentous problems that confront the nation: the problem of coal and the mining industry.

To restore prosperity to the coal industry and to ensure its future means vast changes in its organization and in the utilization of its products. These changes are essential for the national well-being, and they are desirable from our special point of view because, among other things, they must result in the ending of the smoke evil. The rational utilization of coal is economic in itself and economic in so far as it reduces the smoke pall.

The future of the coal industry and the rational use of coal, upon which the future is dependent, is admirably reviewed by Ivor Thomas in "Coal in the New Era" (Putman, 5/-). Mr. Thomas discusses the

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origin, nature, and uses of coal, and details the reasons that have led to the present depressed conditions in the industry in this country. He sees its salvation in a far-reaching rationalization of the industry and in an encouragement of the new methods of treating it that are now being developed.

A key factor is the production of oil by hydrogenation and low temperature carbonization. The importance of creating a market for solid smokeless fuels is stressed, both for the abatement of smoke and for utilizing a product of carbonization. Mr. Thomas comes to the conclusion, which is inevitable to any inquirer, that the use of coal for domestic purposes cannot be permitted to continue.

" Education will doubtless do much," he says' " but many are inclined to think—and the author is among their number—that only a legislative ban on the burning of bituminous coal as a domestic fuel will extend the smokeless fuel market to the size it should be. The harm wrought by smoke is so great, running into tens of millions of pounds a year, that there is a very strong case for a legislative ban on the consumption of bituminous coals in large cities."

He shows that not only will there be benefits in greater smokelessness through this, but that there will also be direct economic advantage to the coal industry ; that the quantity of coal required to supply, as smokeless fuel, the domestic market, will be greater, and that there will be an increase in employment in the mining industry.

The Control of Pollution.

Mr. Thomas goes on to say : " Industrial chimneys are not the chief offenders, for in modern works there is relatively complete combustion of the coal used. The domestic fire is the chief culprit. Unfortunately the individual is slow to realise the evil of burning raw coal, and still slower to take action when realisation comes, though education can do much. He argues that his individual action cannot, in any case, do very much good. But the Government must not adopt this complacent attitude. Our legislators must decide to take up towards atmospheric pollution an attitude similar to that adopted towards solid and liquid refuse. No one can throw his solid refuse into the street ; local authorities provide facilities for carting it away. Liquid refuse is removed by elaborate drainage systems. But gaseous refuse in the form of smoke is poured with impunity into the air. There is a case for controlling the pollution of the atmosphere scarcely less strong than that for controlling liquid and solid refuse. Vitriol-throwing is punishable with severe penalties ; but thousands of chimneys, with their sulphurous fumes, are virtually throwing vitriol into the air every day.

" The co-operation of local bodies with the Atmospheric Pollution Research Committee has produced volumes of statistics dealing with the smoke nuisance. The National Smoke Abatement Society has conducted an intensive campaign against the smoke nuisance, ways of alleviating it have from time to time been suggested, and the Coal Utilisation Council, realizing that smoke is bad propaganda, is offering a prize for the best device to counteract it. But the sands are running out. The need is for remedy, and one is apt to get impatient with statistics and methods of alleviation."

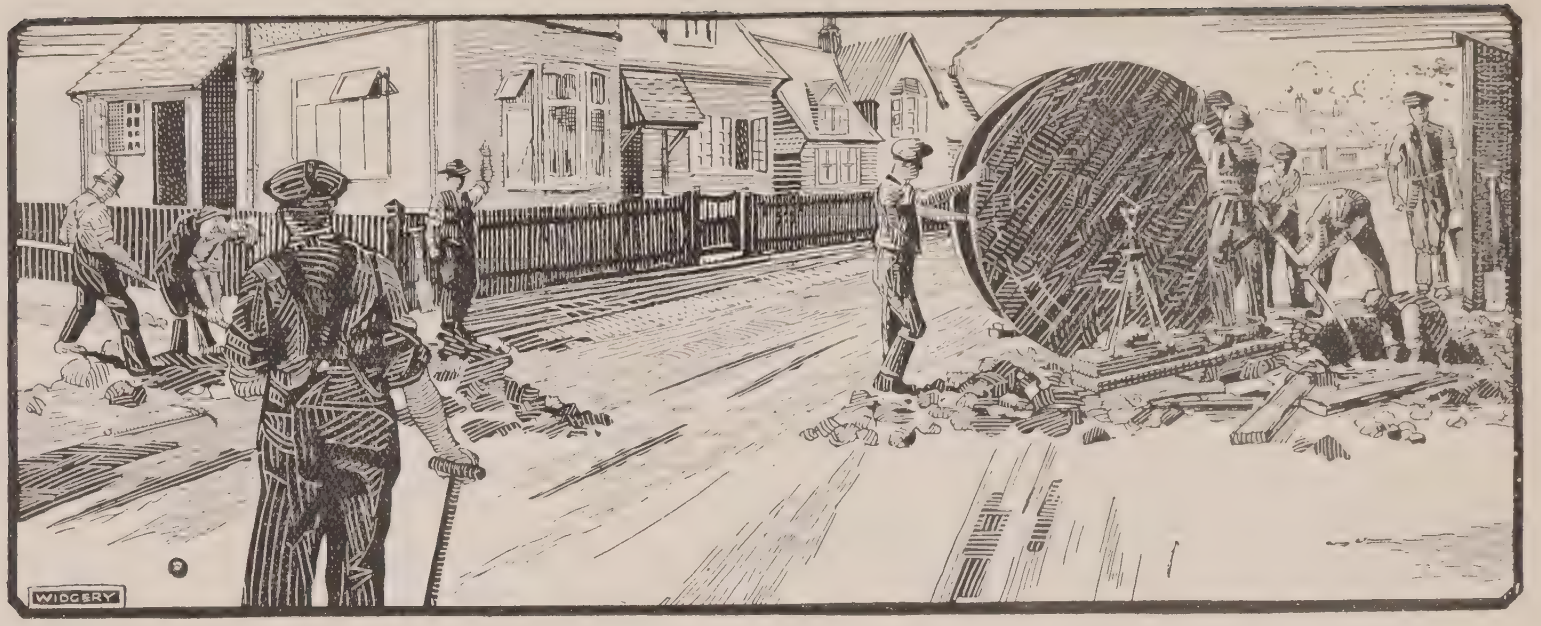
It is suggested that at first the ban on raw coal should apply only to towns of 200,000 inhabitants and over. The suggestion made by Colonel W. A. Bristow that users of raw coal should be compelled to take out a licence is considered and favourably commented upon.

The chapter on science and the miner is extremely interesting and sympathetic ; while the one entitled " Gas as a Motor Fuel " is an admirable review of the position to date of this potentially important development. In discussing the political aspects of the problem Mr. Thomas appears sometimes, as in the " balance of trade " argument, to be treading on dangerous, not to say dubious, ground ; and in looking into the future his use of the definite and prophetic " will " is apt to be somewhat disconcerting, as in such sentences as " As the National Power Board will control such extensive enterprises it will be necessary to have a separate Minister of Power with Cabinet rank."

But such criticisms may be overlooked in view of the well-balanced unity of the survey, and especially in view of the logical way in which the author has considered the smoke evil and included it in its right place as a serious factor in the nation's fuel and power economy.

CHANGE OF ADDRESS

Members and other readers are asked to note that on and after June 24th, 1934, the headquarters of the Society will be transferred from 23 King Street, Manchester, to more convenient offices almost directly opposite. The new address will be **36 KING STREET, MANCHESTER, 2.**



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Fatal Smoke Fogs.

1. During fog in London in December, 1873, the death rate was forced up to 37.5. On this occasion prize beasts at the cattle show were suffocated and others were slaughtered to put them out of their misery.

2. During fog in London in January, 1880, the death rate rose from 27.1 to 48.1, the excess of deaths over the average being 2,994 in 3 weeks. Deaths in Croydon, outside the radius of London fog, rose from 35 to 36.

3. In 1892, after a fog, 1,484 deaths more than usual occurred in a week in London.

4. During a three days fog in Manchester in 1890, 204 people died of respiratory diseases, being twice as many as in neighbouring weeks.

5. In Glasgow, in the year 1909, during a period of five days of dense fog, the weekly death rate from respiratory diseases rose from the October average of 35 (or 2.1 per 1,000) to 233 (or 13.9 per 1,000) for the week ending November 27th. During the two periods of fog in 1909, the death rate rose from 18 to 25 per 1,000—1,063 deaths being attributed to the fog. During the week ending November 27th, the deaths from respiratory diseases in seven small towns around Glasgow rose from 31 to 93. The mean temperature in Glasgow during the week was higher than that of the average of the other towns.

6. During the four weeks ending November 4, 11, 18, 25, 1922, the deaths from respiratory diseases in London were 113, 149, 182, 238, respectively. Fogs occurred between November 12th and 25th.

7. In December, 1930, there was little or no fog in Salford, but during January, 1931, there were nine days of almost continuous fog. The deaths from respiratory diseases rose from 43 in December to 227 in January.

8. There were nine days of fog in Manchester in January, 1931. Deaths from respiratory diseases were 365, compared with 94 the previous December. During the actual week of fog 130 people died from respiratory diseases, compared with the weekly average throughout the year of 20.

Domestic Smoke.

" We are satisfied that domestic smoke, which is being produced by the burning of raw coal, causes serious danger to health and damage to property. Moreover, the burning of raw coal is, from the national point of view, a wasteful proceeding. Not only are the valuable by-products of tar oils, ammonia, sulphur, and cyanogen compounds lost, but, in addition, a large proportion of unconsumed fuel escapes in the form of soot owing to inefficient appliances."—*Report of the Departmental Committee on Smoke and Noxious Vapours Abatement.*

" Domestic Smoke : The burning of raw coal is a dirty, wasteful, and unscientific practice, and on the grounds of economy, as well as of public health, it should be restricted as much as possible."—*Ibid.*

Cost of Smoke in New York.

The per annum property loss due to smoke nuisance in New York City was estimated by Dr. Harris's (Health Commissioner) Committee in 1927 at sixty million dollars. The outlay of 871,420 dollars for the rehabilitation of Central Park, New York, is laid in large part to the destruction of vegetation by the smoke pall.—*Report of the Municipal Art Society of New York*, 1929.

Historic Paintings.

Internally, buildings, particularly of the 18th century, not infrequently possess important paintings, carvings, and distinctive examples of plaster, colour, iron, bronze, and gilt metal work. As instances the very beautiful painted ceilings of Verrio and Thornhill at Hampton Court Palace and Greenwich Hospital can be mentioned, and the Rubens ceiling in the Banqueting House ; all these are seriously affected (by atmospheric pollution).

At Hampton Court the state rooms of Sir Christopher Wren's period are panelled in oak and contain carvings of Grinling Gibbons and his successors. Paintings, panelling, and carving are very adversely affected by the atmosphere of modern London ; they become discoloured and dessicated, and much of the original beauty is irretrievably lost.

The Chapter House at Westminster Abbey contains some highly interesting and significant early wall paintings of the English primitives, dating from the 13th and 14th centuries. Their surfaces have become encrusted and blackened through exposure to the London atmosphere, and although the colours would still appear to exist beneath a black deposit, the present condition shows an astonishing example of soot accumulations through exposure to modern impure air.—*Sir Frank Baines.*

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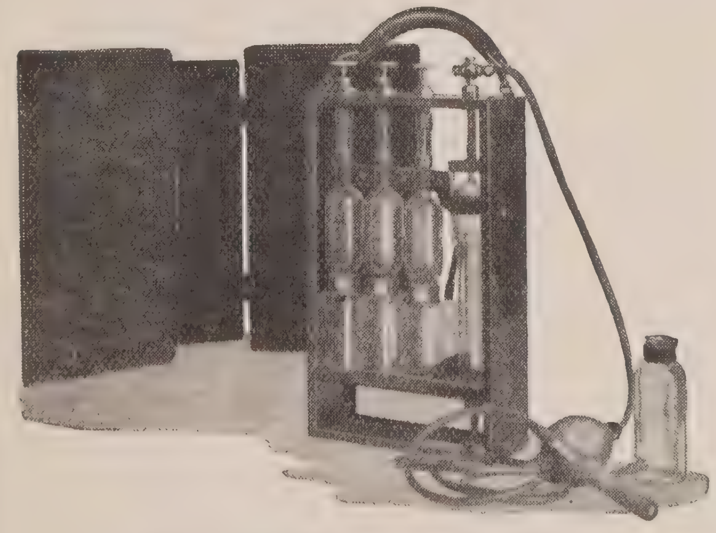

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The Occurrence of Lead, Copper, Zinc, and Arsenic Compounds in Atmospheric Dusts, and the Sources of these Impurities

By **J. T. DUNN and H. C. L. BLOXAM.**

(*Reprinted from the Journal of the Society of Chemical Industry*).

The work now described is in continuation of that which was published last year (J.S.C.I., 1932, 51, 100—102T). Brief references to the progress of our work were made by one of us at the Conference of the National Smoke Abatement Society, held in Newcastle-upon-Tyne, in September, 1932, and by Sir Thomas Oliver, in a contribution to the "Archiv für Gewerbepathologie und Gewerbehygiene," communicated in May, 1932.

In our earlier paper (*loc. cit.*), we indicated that we attributed to the pyrites contained in coals the lead and copper which we found to be present on the herbage and in the soil of pastures in the neighbourhood of works employing coal as the raw material, and we considered it highly probable that if this supposition was correct compounds of these metals would be found upon the herbage, in and around towns and cities, in domestic soots and dusts, in atmospheric dusts, and in industrial dusts produced in works, in which coal was used as the raw material or consumed for the production of power.

We have proved that our suppositions were correct, as we have found that pyrites from coals contain lead and copper almost invariably, and frequently zinc too; also that compounds of these metals are contained in domestic soots and dusts, and industrial dusts from coals, and that they are present in the atmospheric dust of Newcastle-upon-Tyne. We have examined the herbage in purely agricultural districts, remote from habitations, and we have invariably found it free from lead, though we have occasionally found it to contain copper, which appears to be a natural constituent of some grasses. In the herbage alongside of roads much used for motor traffic we have found lead, and this we attribute to the presence of lead tetraethyl contained as anti-knock in some petrols.

In Part I (1901) and Part II (1902—3) of the Report of the Royal Commission on Arsenical Poisoning references are made to the presence of arsenic in household dust and in soot, but we are not aware that compounds of lead, copper, and zinc have been previously found in household and atmospheric dusts.

Samples of pyrites were procured from various coals, and the lead, copper, and zinc in them were determined. The results obtained are expressed in parts per million (mg. per kg.) in Table I.

Table I.

Pyrites from coals.

	Parts per million		
No.	Lead	Copper	Zinc
1	54	4	—
2	20	60	—
3	8	20	—
4	9	none	—
5	5	10	none
6	80	10	40
7	200	50	40
8	183	40	60
9	46	40	40
10	63	35	80
11	217	20	60
12	46	85	60
13	115	5	none
14	100	170	,,
15	8	1	trace
16	none	2	80
17	188	140	none
18	461	20	,,
19	256	40	,,
20	1	5	,,

Nos. 1, 14, and 10 are from Yorkshire, Northumberland, and Nottingham coals respectively; all the others are from Durham coals.

Only one sample contained no lead, and another contained no copper; zinc (and manganese) were less frequently present.

We enlisted the interest of those engaged in industry in our investigations and we have been supplied with a variety of samples which we considered would assist us to trace the course of the lead, copper, and zinc from the pyrites to the atmosphere in as systematic a manner as possible, and would be typical of the part played by coal in all industries as the samples were obtained both from the distillation and combustion of coals.

We were supplied with samples of gas liquor, gas tar and coke, flue dusts of various kinds, dust from the retort houses, and several other materials, and we also obtained samples of domestic soots, from Durham and Northumberland coals, burnt under conditions which we were satisfied excluded the possibility of the introduction into the fires of anything which would vitiate our analyses. The results obtained are stated in Table II.

Our Solution of the Smoke Problem....

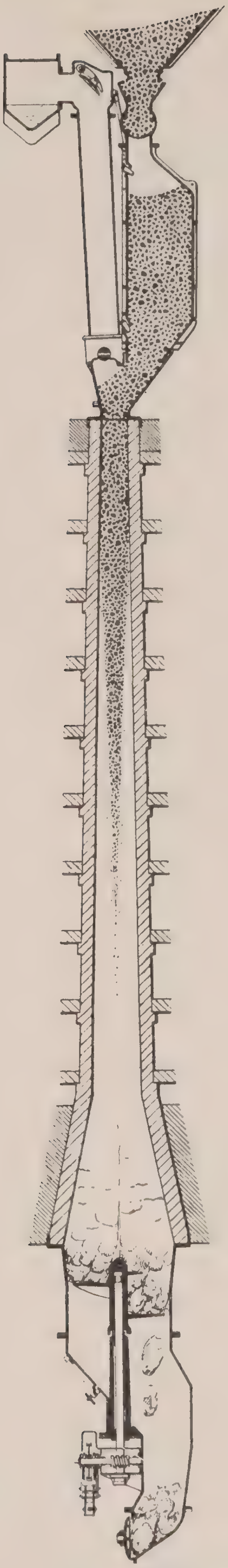

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Table II.

No.		Parts per million Lead	 Copper	 Zinc
21	Gas liquor, from hydraulic main	0.06	none	—
22	,, from storage well	none	,,	—
23	,, from vertical retorts	1.7	2.8	none
24	Gas tar	15	none	—
25	,, ...	17	,,	—
26	,, sample from vertical retorts	23	6	none
27	Gas coke, from vertical retorts	33	10	,,
28	,, used in C.W.G. plant	5.5	180	—
29	,, clinker from C.W.G. plant	3	130	—
30	Flue dust from boiler flue; from coke breeze	1060	650	—
31	,, ,, retort flues ..	341	80	—
32	,, ,, boiler flues ..	376	60	none
33	,, ,, producer uptakes ..	102	160	4900
34	,, ,, waste gas flues in retort house ..	63	55	12,050
35	Dust from top of retort house	113	15	none
36	,, ,, ,,	388	500	200
37	Lining of retorts, part vitrified	118	20	680
38	Retort bricks, after contact with coal inside and producer gas outside	6.5	45	none
39	Retort carbon..	1.5	20	2409
40	Residue from ascension pipe (front side)	1127	120	241
41	Residue from ascension pipe (machine side)	239	2.5	none
42	Ammonium sulphate ..	24	none	12
43	Domestic soot, from Durham coal ..	358	100	none
44	,, ,, ,,	4	18	,,
45	,, ,, Northumberland coal ..	25	20	,,

Lead and copper compounds were found in nearly all these materials, and sometimes zinc also, in some instances in considerable quantities. We do not attempt to deduce anything from these figures as the various products were obtained from mixed coals, and the samples analysed were derived from different sources, employing different mixed coals. Also in the domestic soots, which were derived from unmixed coals, the composition varies with several factors, such as whether the soot is newly deposited or not, height above the fire, whether collected from chimney or flue. The facts stated in the table below served our purpose, which was to ascertain if lead, copper, and zinc compounds were evolved from coals when treated or burned.

We therefore considered it highly probable that compounds of these metals would be present in atmospheric dusts, domestic dusts, and in dusts of any kind deposited in the neighbourhood of towns, or works in which coal was burned. Accordingly we collected dusts from our office bookshelves, portico, and from around the electrical fittings of the ceilings, also from the porticoes of the Labour Exchange in Newcastle. Table III contains the results of our analyses of these dusts.

Table III.

No.	Place	Parts per million Lead	 Copper	 Zinc	 Arsenic
	Public Analysts' Laboratory, 10, Dean Street, Newcastle, Collected Feb. 24, 1932.				
46	Bookshelves in office..	510	1600	6020	80
47	Ceiling, electric bosses in office	3000	1200	12,000	50
48	Portico of front door ..	909	700	none	100
	Newcastle Labour Exchange, New Bridge Street. Collected Apr. 25, 1932				
49	East portico	43	325	4700	160
50	South ,, ...	17	525	2850	400
51	West ,, ...	25	300	1970	140

Samples of grass were collected from some of the open spaces in and around Newcastle. These were examined for lead and copper, and the results stated in Table IV are expressed in parts per million of the dust and grass.

Table IV.

Lead and copper in dusty grass in Newcastle.

No.	Sample collected (on Feb. 23, 1933) from	Parts per million in (dusty grass) Lead	 Copper
52	Town Moor	61	11
53	St. John's Churchyard ..	92	22
54	Keelmen's Hospital ground ..	116	20
55	Welbeck Reservoir	58	9

The Town Moor is a large open space to the north of Newcastle-upon-Tyne, without habitations excepting the Smallpox Hospital in the centre, and rangers' houses on its outskirts, but, as regards smoke, and for the purposes of this investigation, it is surrounded by houses on all sides but the north, and even that side is fast being closed in. The other three situations whence grass samples were collected are all from densely-populated districts, Nos. 53 and 54 being in the heart of the city.

In consequence of the reference made by one of us at the Conference of the National Smoke Abatement Society, held in Newcastle in September, 1932, Mr. C. H. Manley, M.A., F.I.C., Public Analyst for the City of Leeds, and Mr. R. W. Sutton, B.Sc., F.I.C., have carried out the analyses of samples of dusts from six different parts of Leeds, and Mr. Manley's results and conclusions are contained in his Annual Report for 1932; as these have not been previously published, Mr. Manley has kindly permitted us to publish them with ours, and his results are contained in Table V.

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Table V.

Arsenic, lead, and copper in Leeds dusts.

No.		Arsenic (oxide)		Lead		Copper	
		%	P.p.m.	%	P.p.m.	%	P.p.m.
56	Clock Chamber, Leeds Town Hall	0.013	130	0.05	500	0.06	600
57	Turret floor, Market Buildings	0.035	350	0.46	4600	0.15	1500
58	Bell tower floor, Christ Church, Meadow Lane ..	0.012	120	1.50	15,000	0.72	7200
59	Disused office, South Accom. Road	0.018	180	0.44	4400	0.05	500
60	Tower floor, Harehills Congregational Church ..	0.020	200	0.02	200	0.03	300
61	Belfry, Whitkirk Church	0.004	40	0.004	40	0.01	100

Mr. Manley's conclusions are stated in his report as follows : " It is evident that the amounts of arsenic, lead, and copper which can occur in and near the centre of an industrial city are quite appreciable. As was expected, the smallest amounts of all three were found on the extreme outskirts, as represented by Whitkirk. Again, at Harehills, about 2 miles out, the lead and copper contents were less than those in and about the centre of the city, the sieved floor dust from the bell-tower of Christ Church, Meadow Lane, being the most highly contaminated. On the other hand the arsenic content of the latter was actually less than at Harehills. It may be that the lighter particles of white arsenic are carried much further by the wind than the heavier lead and copper. The arsenic is a product of the combustion of coal and coke and of smelting operations. The lead and copper are likely to be disseminated into the air as a result of various industrial processes which are accompanied by the production of the dust of these metals. They may also find their way into the air from the combustion of low-grade coals."

In our previous paper (*loc. cit.*), we described an experiment by which we established the fact that lead and copper compounds are contained in atmospheric dust in the neighbourhood of works concerned with the treatment of coal. We considered it probable that we might obtain useful information by conducting a similar experiment in Newcastle over an extended period. Accordingly, from Feb. 1, 1932, we employed one of the soot gauges for this purpose, and we have continued this investigation down to Apr. 30, 1933. We have various soot gauges situated in and around the city, which we use in measuring the atmospheric pollution, but only one of these could be made available for our investigation ; that soot gauge is situated in the grounds of the Keelmen's Hospital, in the heart of the city, and nearby are the chimney of the electric power station, and the main railway line, also houses and offices.

We determined the lead, copper, and zinc compounds deposited in the soot and dust, and dissolved in the rain water, and we state, in Table VI, the total quantities of these metals deposited in the dust and rain over a period of twelve months.

Table VI.

Lead, copper, and zinc collected in soot gauge, in Newcastle-upon-Tyne, during twelve months.

Area of soot gauge=4 sq. ft.

No.		Lead	Copper	Zinc
62	Contained in the dust and soot (the suspended matter in the rain water), grams..	0.2725	0.0346	0.1115
	Dissolved in the rain water, grams ..	0.0639	0.0069	0.0352
	Total, grams ..	0.3364	0.0415	0.1467
	Equivalent in tons per square mile.. ..	2.22	0.27	0.96

We had hoped to be able to obtain some useful information concerning the deposition of the compounds of these metals at different seasons of the year, but this was found impracticable as the amount of dust and soot varied enormously, even during the same months in successive years. For instance, during March, 1932, the weight of the suspended matters was 12.36 g., and the lead (Pb) contained in it equivalent to 65 p.p.m., whereas in March, 1933, the corresponding figures were 8,218 g. of suspended matters and 5464 p.p.m. of lead.

The variations of the zinc compounds during March, 1932, and March, 1933, were also very considerable ; on the same weights of suspended matters they corresponded to 1670 p.p.m. in March, 1932, and 800 p.p.m. in March, 1933, and during the months of May, June, and July, 1932, no zinc compounds were contained either in the suspended matters or in the rain water.

The copper compounds also varied, but not to so great an extent as the lead and zinc compounds ; in March, 1932, on the same weight of suspended matters, stated above, they were equivalent to 38 p.p.m., whilst in March, 1933, they were equivalent to 200 p.p.m.

We have had occasion to analyse grasses from time to time in connexion with cases of poisoned cattle, sheep, and horses and we have invariably found that grass growing in purely agricultural districts, remote from dwellings and works, is free from lead, although it has been found in some cases to contain traces of copper. On the other hand we have found that grass near the road-sides of roads much used by motor traffic

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invariably contains small quantities of lead and copper, but no zinc. We quote one example in illustration of this point ; samples of grass were taken from the field on the east side of a long steep hill in the open country. but along which considerable motor traffic passes. We collected samples of the grass from the field at points corresponding to the bottom, middle, and top of the hill ; we also collected grass from a field adjoining this hill, but to the west of it, whence comes the prevailing wind in that district. The results are set out in Table VII.

Table VII.

No.	Position and directions whence grass samples were collected	Parts per million (in dusty grass)		
		Lead	Copper	Zinc
63	Top of steep hill, east side of the road	7	4	none
64	Middle ,, ,, ,,	5.5	7	,,
65	Bottom ,, ,, ,,	7	4	,,
66	Top of the hill, west side of the road	none	1.2	,,
67	Middle ,, ,, ,,	,,	0.4	,,

In other cases we have obtained similar results, that is to say, near to the road-side, to the leeward of the prevailing wind, of roads carrying much motor traffic we find the grass has lead compounds deposited upon it, but on the windward side of the road the grass is free from lead. We attribute the lead so found to the lead tetraethyl contained in some motor spirits. We have had occasion to analyse deposits from the valves and cylinders of motor cars, and in two instances we have found them to contain lead compounds ; one deposit, from a valve, contained 82.7% of lead sulphate, and the other, from a cylinder, contained 31.06% of lead sulphate and 2.02% of lead oxide. On inquiry we found both cars were using motor spirit containing lead tetraethyl.

Dusts containing such toxic substances as compounds of arsenic, lead, copper, and zinc, if not actually poisonous, may be expected to be injurious to health. During the past few years we have been consulted about the deaths of sheep and cattle, and we have found the dust upon the herbage, on which they had fed, contained these poisonous substances, and we found them in the organs of those animals. We also found the organs of fowls to contain lead and copper, which were also present in the coal-ash heap to which they had access just before they died. Out attention was called to a case in which fowls had beome ill, owing to dusts, of similar composition and origin to Nos. 30 to 36, having been used to make up the floor of the fowl-house, and the path in the run ; fortunately in that case the source of the illness was at once suspected and the dust removed and the fowls recovered.

Lately we had to investigate the cause of the death of a child of 5 years of age, whose death could not be accounted for, and in whose organs we found lead, seemingly in too small quantity to have been the cause of its death. That child had lived a very protected life in an Institution and under such careful supervision that it was virtually impossible that it could have had access to anything containing lead, and we can only think that the lead found in the body must have been air-derived.

We have examined the urines of thirteen men from works employing coal as the only raw material, and in the urines of six of these men were found lead.

Another influence which these metallic compounds may have is that of assisting the corrosion of galvanized surfaces, and of other unprotected metals, and if, as Mr. Manley suggests, these metals may in some cases be present, as such, in minute particles in dusts, those particles would probably also act as centres of corrosion.

We wish to express our indebtedness to our assistants, Mr. G. C. Redpath and Mr. William Marsden, who have assisted us greatly in this work during the three years in which it has been in progress.

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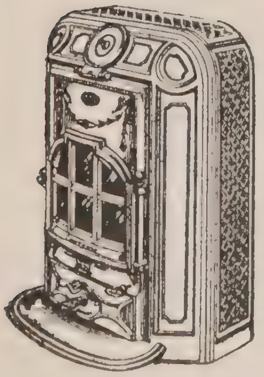

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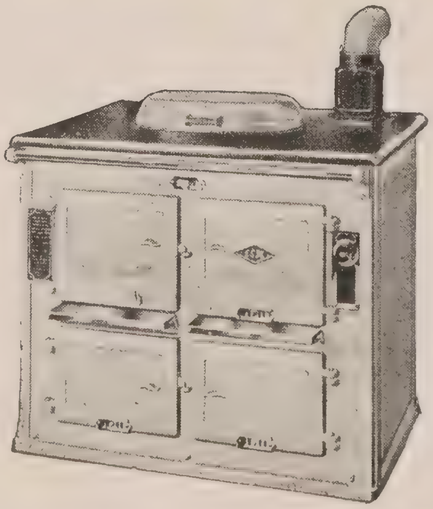

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The Journal is open for free discussion of all aspects of the smoke problem, and the opinions expressed in contributed articles are not necessarily the same as the views of the Society. Quotations and abstraction of matter appearing in the Journal is welcomed, provided the usual acknowledgements are made.

COMMENTARY.

ARRANGEMENTS for the Annual Conference at Glasgow, in September, are now almost complete, and already a good attendance is assured. A subject that will be of especial interest to the representatives of local authorities is the "Measurement of Atmospheric Pollution," a paper on which will be read by Dr. J. S. Owens, who, as Superintendent of Observations of the D.S.I.R. Committee, is more qualified than any one else to deal with it. Smoke and Sanitary Inspectors will also be interested in a demonstration that Dr. Owens has promised to give on a new instrument he has devised for measuring the intensity of smoke emission.

Another paper that will be of unusual value will be on "Slum Clearance and Smoke Abatement," by Dr. J. Johnstone Jervis, Medical Officer of Health for Leeds. Dr. Jervis is a member of the Society's Executive Committee, and Honorary Secretary of the West Riding Regional Smoke Abatement Committee, and at the moment is very busy with the extensive slum clearance schemes that are being energetically undertaken by the Corporation of Leeds. The Society has already stressed the importance of considering smoke abatement in connection with the rebuilding of cleared areas—the resolution passed at Sheffield last year will be remembered—and Dr. Jervis's first-hand knowledge of the problem, coupled with his intimate understanding of the smoke problem will produce a paper that will be of material value in presenting the Society's case once more before those who are concerned with housing, but who are, only too often, somewhat ignorant of the health and amenity importance of smoke abatement in the planning of new housing areas.

The Glasgow Corporation is to entertain us to a Civic Reception and a tour to the Trossachs, while the Scottish Branch at its own session on the Friday afternoon, is arranging for a talk and demonstration on the effects of smoke upon vegetation by Mr. William Besant, Superintendent of the Glasgow Parks. Councillor W. Brownhill Smith is to give an address on this occasion with the picturesque title of " Nature is Beautiful and Rejoices in her Loveliness. Only Man is Vile." With Mr. Besant's living—or half-living—exhibits around us there is no doubt that this proposition will be unanimously approved.

It is a sign that the words " smoke abatement " have not yet become as familiar with the general public as they might be when a parcel arrives at the Society's offices in which the name has been transformed to " The National Smokers' Abstainers Society." This is amusing, even if it does not reach the same absurd standard as "The Smoky Bacon Society" to which an account was once rendered. Thus, even to-day, it is apparent that smoke abatement is not exactly a household term, and that being so it may be deduced that an awareness of smoke and its effects is not as common as we should like.

Smoke abatement activities in Belgium and the United States have been noted in the Journal recently, and it is now a pleasure to give paragraphs to the work of organizations in two of the Dominions. In Canada the Smoke Control Association of Toronto has recently been formed, and is described as a voluntary citizen organization made up of representatives of service clubs and other organizations " not financially interested in any equipment for or method of smoke prevention." Its methods are entirely co-operative and educational, as it believes that the effectiveness of legislation depends very largely upon the understanding of citizens and property owners of the value and methods of smoke control. Good wishes for the success of its work have been sent by the N.S.A.S., and it is hoped that we shall be able to keep in touch with it as we do with other bodies elsewhere.

The Sunlight League of New Zealand, which is a member of the Society, is actively concerned with the smoke problem, which, though it may seem strange to us, exists also in that pleasant country. A series of radio talks have been given during the past few months on sunlight and health, and on June 4th, the subject was " Smoke, Soot, and Sunlight," by Dr. T. Coleridge Carr. The League has taken an interesting figure as its emblem, being Maui, a great Maori hero. The legend, which is extraordinarily appropriate, runs as follows :—The Sun became lazy and instead of slowly traversing the heavens, allowing his beneficial rays to shine upon the earth spent most of the twenty-four hours resting underground. Through insufficient sunlight the health of the people began to suffer severely ; also the food supply decreased and deteriorated. Maui, the great hero and benefactor of man, set forth to snare the Sun, in order to make him promise to journey more slowly across the heavens, and so bring back health to mankind. The League's design shows Maui in ambush, beginning to tighten the rope of the snare before the struggle. Finally Maui completely vanquished the Sun, who, in his pitiful state, promised that he would travel more slowly through the sky and give man a longer day of light. Ever since this mighty deed of man's, the Sun has kept faith, and slow and measured has been his daily journey across the heavens, and in consequence man and the fruits of the earth have greatly flourished.

An enterprising firm of coal merchants recently decorated its shop window in the centre of Manchester with a rock-garden, complete with an excellent selection of flowering plants and alpines, in which the rocks were large pieces of household coal and the crevices in which the plants were placed were covered with fine slack. It all looked very unnatural, but nevertheless pleasing, in a bizarre kind of way, and we congratulate the firm upon having at last discovered a use for household coal that is quite harmless.

Factory Smoke

A Paper Read to the Members of the Manchester and District Regional Smoke Abatement Committee.

BY R. H. CLAYTON.

I have been requested to give this address on the subject of Factory Smoke, primarily from the fact that I am engaged in factories where coal is consumed for the usual industrial purposes.

I think the request has been well founded in that many writers on smoke abatement are not coal users and have so little, if any, practical experience on steam production, hence their papers are subject to criticism from the consumers of coal, which weakens the cause of smoke abatement in general.

Whilst I hold the view, and always have done, that factory smoke is not the major cause of air pollution in cities, I am just as anxious as other smoke abaters to stop its emission, in that any large emission of factory smoke is avoidable, and whilst such an air pollution is allowed, the campaign against the greater evil—domestic smoke—tends to be overlooked and neglected.

In this paper I will confine my attention to Lancashire boilers, which are in the majority in this district, and will deal only with black smoke and not with grit and sulphur fumes, which are at present engaging the attention of the larger power stations for electricity production, in which stations tubular boilers are the accepted type.

Lancashire boiler plant installations may be divided into two classes, namely, small and large units, as the remedies for smoke emission are not equally applicable.

Small Units.

The smaller unit of one or two boilers is seldom suitable for mechanical stoking devices on account of the fact that the steam demand is often of a very intermittent nature and there may be no call for a great duty from the boiler, nor is any economy in labour possible to off-set the cost of mechanical stoking. In each case the use of coke is a sure remedy, and we use coke on such a one boiler unit where the steam demand is intermittent and not high. In recent years the quality of the coke available has considerably increased in value, owing to the improved quality of the coal carbonized, as regards ash content, and also to the fact that the method of quenching has been modified, so that the moisture content in the majority of cases is now very low. If coke contains, say, only 8% ash and under 5% moisture, its calorific value approaches that of the usual industrial slacks in use. It is regrettable that any of this smokeless fuel is exported at low prices rather than used for smoke abatement purposes, both in the factory boiler and the domestic hearth. By the use of coke heavy fires can be maintained and excess air, both over and through the bars, avoided, so securing more economical firing than when using coal with excess air passing through the bars of the grate, as may well be the case where the chimney is a smokeless one. Should this alternative not be possible, then the training courses at present given to firemen should be of great value, especially when a boiler is in constant use and the differential price between coal and coke is too great to warrant the use of the latter. Unfortunately, however, it is in outside districts where the principal offenders are located, and no such courses exist in these districts. On the other hand, many of these smaller boiler units are dying out, owing to extended use of electricity as a motive power.

Large Units.

As regards larger units such as exist in the Lancashire district, and our main boiler installation is such a unit, it may be of interest for me to state that in our case we have passed through various periods of development. The first period was hand-firing with occasional appearances in the Courts for smoke emission, then three successive periods when we used various types of mechanical stokers, which have cost us in all some £2,500 to install. I can claim, therefore, that we have not allowed the matter to rest and have always striven to secure the best results. I must state here that the constant attention of the Smoke Inspector helped materially at the start to secure the acquiescense for the spending of money, and had no such control existed it would have been more difficult to get the necessary consideration on such matters by the heads of the firms.

Boilers in many works, unless on a large installation, are looked upon as a necessary evil which one tends to ignore, in order to devote full time to the actual production of goods. It is impossible for any manager to constantly watch the chimney top, and in most cases he probably never sees it all day long. He is, therefore, entirely in the hands of the stoker as regards smoke emission.

Now as regards the economies of steam raising, the statement is often made that black smoke means great loss due to unburnt carbon, and the ardent smoke abater puts himself forward as a friend who is only working for the firm having his attention. This loss of unburnt carbon as such, is small, even when dense smoke is being made. It is estimated by Scheurer Kestner that it is only 1% of the coal burnt in the boilers, other investigators have given similar figures. These

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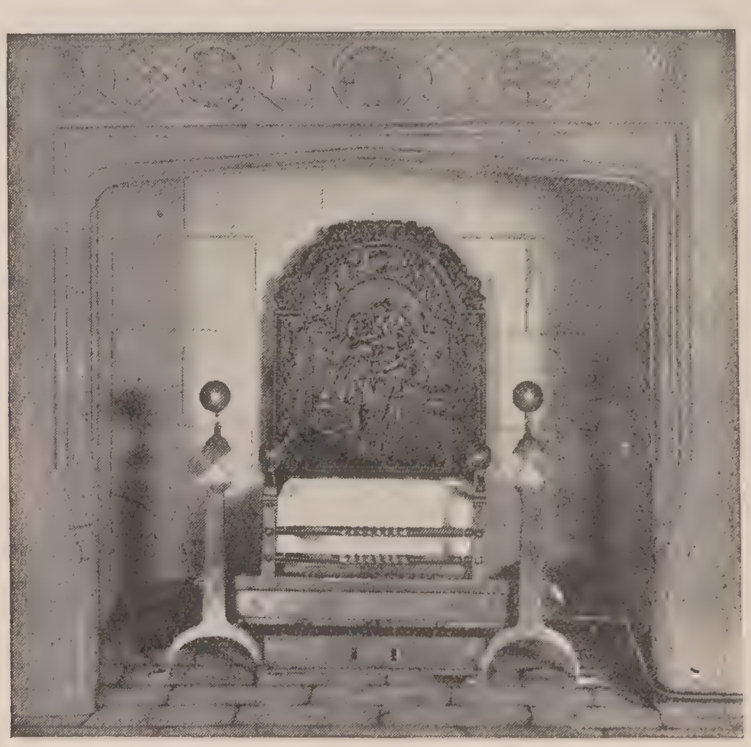

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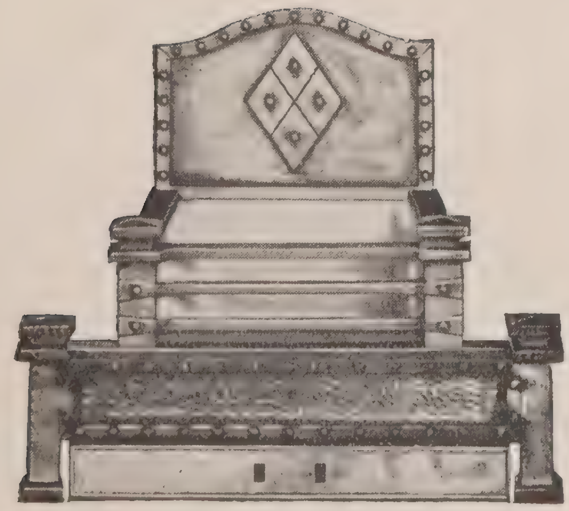

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figures must not be confused with figures given in regard to domestic smoke, which are of a very much higher nature. If, to avoid this emission of black smoke, the doors of the furnace are left open an undue length of time or the bars of the grate not covered with fuel, in which case the smoke is consumed by the excess of air passing, far greater losses are incurred than when black smoke is made. This is easily demonstrated by the figures with which fuel experts are conversant and fuel users well know by practical results. Taking 14% of CO_2 in the waste gases as "bogey," that is to say, the minimum quantity of air is allowed to pass through the furnace, then any excess air will reduce CO_2 content and bring about the following losses.

Percentage loss of fuel in waste gases to chimney :—
(*a*) at 200°C ....392°F
(*b*) at 250°C ....482°F

Percentage loss on fuel :—

CO_2	A.	B.
14%	0	0
12%	1	2
10%	3	5
8%	6	10
6%	13	17
4%	24	31

With small boiler units, economisers are not generally installed, so that the loss in the waste gases, when the CO_2 content is low, may be even more excessive.

It is, therefore, fairly obvious from these figures that the tendency for the economical working of the boilers not under strict scientific control is to make smoke where the CO_2 content is high and the waste heat losses low. The man in charge knows this from his weekly figures of coal consumed, which is probably his only check on the boiler installation.

Mechanical Stokers.

Now as regards the future of smoke abatement in large Lancashire units, we are in a mechanical age and I look to mechanical means for the solution. I am a strong advocate of mechanical stokers which achieve many good results. First and foremost, a less smoky chimney is the result, even with hand-firing at its best. It is unreasonable to expect any man to be a perfect machine, and labour is now being educated above mere drudgery. Mechanical stokers produce more steam per boiler and labour is less onerous and more economical, whilst on the other hand there is extra capital expenditure and cost of upkeep to set against the advantages. As regards the upkeep, mechanical stokers fall into the class where "a stitch in time saves nine" and it is essential that the first daily job of the fitting staff should be to run over the stoking machinery and see that all is well greased and in order and any wear should be immediately rectified. Under such conditions renewals are small and in our case over a five year period renewals on our stokers have cost 5% per annum of the original cost. Not an excessive sum. The estimated cost for the next five years is 7½%. Whether smoke abatement costs less or more than smoke emission, is, however, to my mind not the main issue.

In the paper given by Mr. C. Gandy and myself at the meeting of the National Smoke Abatement Society held in Sheffield last year, we emphasized the point that enormous sums are spent annually in welfare work, such as sewage purification, refuse disposal, housing, etc., which expenses are already carried by the firms, their operatives, and all the dwellers in the district. It is therefore logical to assume that such expenditures should not be nullified by volumes of black smoke emitted from factory chimneys.

Legal.

In my last section I wish to deal with the legal aspect of the factory smoke question.

I do not favour the increasing of the existing obligations, but only their logical application to all, whether in cities, suburbs, or in the rural districts. Black smoke is not a local pollution, as anyone with eyes to see with can observe when hiking in the Peak where the sheep are black from smoke emanating from Lancashire and Yorkshire. It is an interesting study whilst travelling to note the colour of the sheep's wool, and one must go far from industrial areas before the wool is seen to be free from smoke contamination and is of the colour nature intended.

Much harm, in my opinion, has been done in the past by "cranks" trying to get unreasonable clauses inserted in new Bills, such as the clause "no black smoke, etc." As a user of coal I know how difficult it is to conform to the Manchester regulations, where a certain amount of black smoke per half hour is allowed. We are dependent upon our labour, and labour at, say, 1s. 2d. per hour, is not always blest with the highest intelligence, nor is it necessarily interested in the purity of the air; hence, great opposition to new smoke Bills with more stringent clauses. I may say here that, even with our mechanical appliances, an ardent Inspector could, if he so desired, land us in the Courts for excessive smoke emission in many weeks of the year. "Cranks" have their uses in continually winding up a movement, and are acknowledged as a necessity, but they may unconsciously do harm by overstressing their case, so creating unreasonable opposition. Intelligent co-operation is what is wanted and I am sure it can always be obtained by the right methods. This brings me to the personnel of the smoke abatement movement and its general organization. It is not a local question but a national one, and in the evidence I gave before Lord Newton's Committee, when it sat in Manchester, I advocated a national policy, similar to the Alkali Inspectors organization, which has control of chemical fume's emission, a very small pollution compared with factory smoke emission. Our

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acid plant is under this national control and we are under penalties if more than four grains of SO_3 per cubic foot pass out into the atmosphere, and rightly so. On the other hand sulphur in the SO_2 passing into the atmosphere from our boilers is far greater than that from the acid plant. There are only 12 acid plants in operation in the Lancashire district which, as I stated, are all under careful national supervision, and it is interesting to compare this state of affairs with the control of the black smoke emission in the Lancashire area.

The Alkali Inspectors, under their chief in London, are all scientifically trained men with special knowledge of their subject, whose visits, co-operation and aid are welcomed by the firms under their supervision. Direct contact between these Inspectors and the heads of the firms is a co-operative movement which ensures understanding of the difficulties; therefore, goodwill, and healthy co-operation. It is difficult to understand why the Police Court seems to have been the only organization allocated to smoke abatement, and that only in the more progressive cities where the byelaws are put in force. The new Regional Smoke Abatement Advisory Committees now being formed are a step in the right direction, but I am not acquainted with the powers alloted to them. Shall we have the Gilbertian position, that the Chief Magistrate of any area will be summoned for the non-fulfilment of his duty, in which case he will, after an observation has been made on a defaulting chimney in his area, receive a Blue Paper, with a demand for his attendance at a certain hour at a certain Court, not necessarily his own. He will there wait until the drunks and disorderlies are tried, and then step in the Dock and hear in measured tones the enormity of the chimney's failings, hardly believing that the said chimney had the capacity to commit so dire an offence. Like all of us, he would not have seen the particular emission of the smoke referred to, so could not refute it. There would be a quick verdict of guilty and a fine of, say, £5 inflicted, and may be a cash payment demanded before he left. We have been through this, and I can assure you that the £5 is the least hardship, and the result, the greatest hatred by the staff in the prosecuted firm of the whole smoke abatement movement.

I am sure, after such an ordeal, it would be appreciated on what a low level the whole question has been conducted.

In the Alkali Inspectors' organization we have the benefit of valuable consultation, and the whole matter is carefully considered, and what is possible tried out.

It is very gratifying to know that Regional Smoke Abatement Advisory Committees have been formed, and are in course of formation. It is a step long overdue, and will help to achieve considerable improvement. It is the first step to a national control, which should follow as a natural sequence. If such a national control were inaugurated, the whole subject would be raised to the level of the organizations at present dealing with other sanitary matters, and a great help to the Inspectors at present working under the Medical Officers in the respective districts.

In conclusion, may I ask are we not quite behind the times in all smoke abatement matters? Why should our small voluntary National Smoke Abatement Society really have to carry on year after year urging many authorities to do what they have done? In education in sanitary matters and in scientific progress we have no reason to say we have not kept pace with world progress, nay, we have led in many reforms for the benefit of the masses. I am, by force of circumstances, a traveller in foreign lands, and when I return to our industrial districts with their foul atmospheres, my opinion of English intelligence suffers a severe shock.

A Compensated Smoke Tax

The Editor

Journal of the National Smoke Abatement Soicety.

SIR,

The proposal that the Government should levy a tax on coal sold for domestic consumption in the raw state, with the object of encouraging the production of smokeless fuels, has often been discussed. I expect the reason the proposal has not received much attention is that it would, for a time at any rate, place a heavy burden on the household budget, and on this account would naturally be very unpopular with the majority of the population.

I would like to put before the members of our Society the suggestion that the objectionable features of a "smoke tax" could be eliminated by incorporating in the scheme arrangements to simultaneously lighten taxation on other household necessities by an amount equivalent to the tax imposed on coal.

If one were at the same time to avoid suggesting interference with Empire preferences and duties designed to help home industries, it would be possible (I am hoping) to devise a measure that would appeal to all who realize the folly of allowing atmospheric pollution, without at the same time antagonizing those on whom this has not yet dawned, but who are interested in one way or another in preferences o duties.

THE WOODALL-DUCKHAM VERTICAL RETORT & OVEN
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I am not quite certain, however, whether the purely revenue-raising taxation on household necessities is enough to enable us to compensate for the coal tax without interference with preferences, etc., and I am hoping that someone who understands this side of the matter more fully will express an opinion on it.

The following figures will give some idea of the position :—

Taxation on household necessities in 1933 :

	£
Tea	2,119,000
Coffee and Cocoa	924,000
Sugar	11,380,000
Matches (Excise duty only) ..	2,107,000

making a total of 16½ million pounds (the list may not be quite complete).

If a tax of 4/- per ton were imposed on raw domestic coal, this would—as long as the country continued to burn 40 million tons as at present—cost the consumers 8 million pounds. We should not, therefore, have to remove more than half the above duties to compensate householders for the coal tax.

If the scheme would not be practicable on the lines indicated above, I am still hopeful that some other method of compensating the householder could be devised.

As regards the difficulty of collecting the tax, and distinguishing between taxable and non-taxable coal, we have a parallel in the case of alcohol, which is much easier to smuggle than coal would be.

The very high tax on petrol and the subsidizing of hydrogenation show that the Government is willing to go a long way in altering taxation in order to help the fuel industries and create employment, and it is likely that a measure of the type suggested would create new industries and expand existing ones on a much larger scale.

In conclusion I would suggest that a " compensated smoke tax," such as has been outlined—if the tax compensation part of it could be arranged—would create such a volume of public interest that the difficulties which are at present retarding the development of smokeless fuels would be speedily overcome. Without some such stimulus I am afraid progress will be painfully slow—perhaps a few hundred thousand tons less raw coal burnt each year—but we have 40 million tons of raw coal to replace.

Yours, etc.,

H. F. TAYLOR.

Innisfree,
Light Alders,
Disley, Cheshire.

The Symposium

A Review of the Caxton Hall Meeting.

The summer meeting that the Society holds each year in London this time took the form of a symposium on smokeless open-grate fuels. There were eight papers, four during the morning session and four in the afternoon. It was a full programme and, when the number of people indicating their desire to take part in the discussion became much greater than had been anticipated, it seemed that the time allotted for each discussion would be entirely inadequate. Thanks, however, to the warnings of Dr. Des Voeux, who was in the Chair, and the absence of undue verbosity in any of the speakers in the discussion, the time-table was not lost sight of, and everyone who wished had the opportunity to speak.

The papers in the morning were devoted to the fuels themselves and in the afternoon to various aspects of the fuels in use.

The first paper, on natural smokeless fuel, in the absence of the author, Mr. E. K. Regan, was taken as read, and was followed by Mr. Nicol on " Gas Coke." Mr. Nicol is the Technical Advisor to the London and Counties Coke Association, and his paper was an authoritative and confident survey of the position and outlook for this widely-used fuel. Colonel Bristow, speaking not as the head of a particular company, but as the representative of the Low Temperature Coal Distillers' Association was the third speaker, and he admirably presented the case for fuels produced by low temperature carbonization. He went one further than the others and stressed the therapeutic value of the radiation emitted from fires of smokeless fuel. This abolishes the claim of superiority advanced on behalf of raw coal, which maintained that radiation from a coal fire was unique in its curative properties. It is no doubt valuable, but there seemed no reason why carbonized coal should not have similar emissions, and it is good that Colonel Bristow has given his authoritative view on the matter.

The last of the morning papers was by Mr. H. Cerckel on " Coke Oven Fuel." Domestic fuel produced in coke ovens with the necessary modifications of practice is potentially of great importance, and Mr. Cerckel surveyed the present position concisely and clearly.

The discussion that followed, like all discussions, had a tendency to divert from the specific matter contained in the papers, and perhaps was chiefly valuable for the variety of personal experience and opinion it produced. The chief fault was a tendency to debate the merits of the various fuels in comparison with each other, as if they were wholly antagonistic and not largely complementary.

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Dr. J. G. King made a valuable contribution regarding recent experiments at the Fuel Research Station, and Dr. Lessing's not unexpected plea for the use of clean coal stressed what is one of the most important of the many technical problems associated with the popularization of smokeless fuel. It was interesting to hear the views of Mr. John Charrington, Jr., as a London fuel distributor, on the growing interest in smokeless fuels that was apparent in the metropolitan area.

The Afternoon Session.

Mrs. G. H. Miles, of the National Council of Women, opened the afternoon session with her paper dealing with the subject from the point of view of the housewife. This was an essential part of the symposium, for Mrs. Miles was speaking as a consumer among those mainly interested in production ; as one concerned only with domestic and not fuel technology.

Then came the papers by Dr. G. E. Foxwell and Mr. John Roberts, who collaborated a short time ago in a paper entitled "The Manufacture and Sale of Open-Grate Coke" to the Institute of Fuel. On this occasion Dr. Foxwell dealt with development and marketing, and Mr. Roberts with the properties required in an open-grate fuel. Mr. Roberts' paper—like that of Mrs. Miles—should be studied with care, and its statements taken almost as axiomatic, by everyone who considers producing or selling a fuel for domestic use. The properties required for a successful fuel are very definite, and unless they are obtained and maintained, public confidence and appreciation cannot be gained.

Dr. Foxwell's paper was, as he admitted, revolutionary in character, and was in effect a criticism of the present lack of co-ordination in the production and distribution of high temperature coke. In view of this the speaker made the proposals for co-operative production and marketing of the fuel that are recorded elsewhere. It is a pity that the discussion did not approach more closely to this important question, and that the comments that were made were mainly adverse. The reason for this, however, appears to have been a general feeling that the action proposed was not of a kind that ought to be taken by the Society, even supposing that it was of a useful character. Subsequent criticism of the discussion and of the value of the Society as a medium for "positive action" in the columns of *The Gas World* might better have been directed, if they were necessary, against those who would be directly concerned with the proposed schemes rather than against the Society. The whole question is highly technical—in a commercial even more than a scientific sense—and with the Society's technical members disinclined to give their approval it was obviously not desirable for the Society to take the desired positive action.

Dr. E. W. Smith, in a short but comprehensive address, summed up the preceding papers and discussions and surveyed the whole question of solid smokeless fuels as it affected the national economy. His reasoning was close and judicious, and was a fitting end to a meeting that had ranged widely over a number of topics of surprising dissimilarity.

The Evidence

A Second Selection of Useful Statistics and Pronouncements.

Health.

We have received evidence with regard to the damage done to the health of the community by a smoke-laden atmosphere, and are satisfied that smoke has a serious effect on the general health.

Statistical evidence shows a close relation between the death rate and atmospheric conditions ; the number of deaths from pulmonary and cardiac diseases is shown to increase in direct proportion to an increase in the intensity and duration of smoke fogs. The cause underlying the high mortality in towns, which is known to follow in the wake of a fog, must operate continuously though in lesser degree, on the health of an urban community.—*Committee on Smoke and Noxious Vapours Abatement, Interim Report.*

I feel on safe ground when I say that the majority of lives lost from respiratory diseases are lives thrown away. Their prevalence and the high mortality due to them are a grave indictment of our modern civilization. They are preventible ; yet they are not prevented. They are curable ; yet they continue to kill. Prevention can only be achieved by tackling the smoke nuisance resolutely.—*Dr. J. Johnstone Jervis, Medical Officer of Health, Leeds.*

It is just as hard to earn a living in Reading or Northampton as in Bolton or Warrington, but it is much easier to die—nearly twice as easy if you are a man between 45 and 65—in Bolton as in Reading.—*Dr. Greenwood, Statistician to the Ministry of Health.*

Corrosion of Steel.

Ordinary railway section steel rails were placed in suitable positions by the side of the line and weighed at intervals, the loss of weight being recorded. The annual loss of weight by corrosion was as follows :—

"Safety First"

	Loss of Weight. (lbs. per annum per yard)
On Sea Coast among Sandhills	0.18
In the Centre of a Town	1.04
Dry place in smoky tunnel	1.48
Wet place in same Tunnel	1.71

The observations extended from 8 to 17 years.

In 1905 the roof girders at Charing Cross Station collapsed through rusting. One sample of rust from a lateral girder contained 4.25 per cent. sulphuric acid (SO_3), equal to 8.95 per cent. of iron dissolved as ferrous sulphate.

Effects upon Vegetation.

The sulphuric acid deposited from the air on trees as the result of burning coal containing pyrites and sulphur in other forms, acts as a persistent and gradual caustic, eating into the tissues not only of the leaves, but of the more delicate twigs and branches. Sulphurous acid acts in an entirely different way and its injurous action is more manifest in herbaceous and so-called soft-wooded plants. It enters into the intercellular passages and probably acts directly on the protoplasm. In addition we may have various other products of the destructive distillation of coal, of which there are probably a large series which are toxic to plants, but the effect is more obscure. It seems certain, however, that sulphurous acid is by no means the only substance in smoke that is injurous to vegetation. The actual deposit of a coat of finely divided carbon mixed with other substances is undoubtedly injurous. It should also be borne in mind that anything calculated to reduce the general vitality of a plant or tree makes it more susceptible to the attack of other injurious agents, such as a fungus or an insect, and we may have damage indirectly due to the effect of smoke which may appear to be caused by some entirely different agent. Even though the plant may not be killed immediately by a concentrated dose of the deleterious agents present in smoke, the effect upon its blooming and rate of growth is most marked.—*Dr. George T. Moore, Director, Missouri Botanical Garden, St. Louis, U.S.A.*

The damage done to indoor plants is most noticeable during a foggy period; one of the worst fogs experienced during one winter caused practically all orchid flowers and unopened buds to fall in less than 24 hours, whilst leaves of begonias and other plants fell in large numbers. The bill for glass washing at Kew after a fog amounts to approximately £100.—*Dr. Hill, Director of Kew Gardens.*

Pittsburgh Inquiry.

The inquiry into the cost of smoke made in Pittsburgh in 1912 showed that the cost for one year was £2,161,000. The cost per head was $20 or £4. The measured sootfall was 1,031 tons per square mile.

Smoke Abatement Committees

Reports from the Regional Committees and the Scottish Branch.

THE WEST RIDING OF YORKSHIRE

In the Annual Report of the West Riding Regional Committee an account was given of an examination of atmospheric dust. Analyses were made by Mr. C. H. Manley, Leeds City Analyst, of samples taken from dusts collected at various points in the Leeds area, and the presence of considerable amounts of arsenic, lead, and copper is shown. For example, dust from a church tower in Meadow Lane, was found to contain: Arsenic, 120 parts a million; Lead, 15,000 parts; and Copper, 7,200 parts.

The Committee are agreed that the presence of these substances in the atmosphere was disturbing. Bradford, Halifax, Huddersfield, and Wakefield authorities were invited to take part in the investigation and their samples showed a certain similarity to those taken in Leeds, with the exception of a smaller proportion of lead and copper at Huddersfield.

Regarding carbon monoxide poisoning among employees in public garages, a preliminary investigation at Leeds showed that in at least two of the garages visited, cases of illness had occurred which, from the symptons, were probably due to the inhalation of carbon monoxide. The Committee think seriously of the matter, and Dr. J. J. Buchan, of Bradford, is to take blood samples of people exposed to the fumes of motor-car exhausts. The committee are of the opinion that the running of motor-car engines in enclosed garages should be forbidden beyond a definite length of time, and that efficient means of ventilation should be provided.

MANCHESTER AND DISTRICT REGIONAL COMMITTEE

It is reported that the plan to establish a joint smoke abatement board for South-East Lancashire has been revived, and a new report on the subject is in course of preparation. It will be presented to the Manchester and District Regional Smoke Abatement Committee at its November meeting, and it is hoped that the 100 local authorities in the region will give the scheme their support in order to reduce the smoke pall of South-East Lancashire by such co-operative activity.

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The report will follow the main lines of the 1931 report, which in the financial crisis was ignored. The comparative smoke-emission observations will be brought up-to-date, however, and there may be a few additional suggestions. In the 1931 observations it was found that the emission of dense black smoke in the districts of 33 local authorities, where smoke inspectors cannot be afforded, was thirty times as frequent in Manchester. The board, under the 1931 proposals, was to consist of 40 members elected proportionately by the local authorities, and its work would be financed by contributions which were not to exceed one-fifth of a penny in the pound.

THE SCOTTISH BRANCH

The twenty-fourth annual report of the Scottish Branch states that although the public, speaking generally, seem to look upon the smoke pollution of the atmosphere with indifference or accept it as a painful necessity, yet it is encouraging to note that public interest in the devastating effects of a smoky atmosphere is apparently being awakened, as is shown by the increasing number of complaints received by the Medical Officer of Health for Glasgow as to smoke nuisances. During the past few years the average number of such complaints has been 150 per annum. The increasing interest of manufacturers is also evident in the replacing of older patterns of steam-raising plant by modern up-to-date plant, with mechanical stokers, or with heating system by gas or electricity. The spread of knowledge among employers and stokers as to the proper methods of stoking so as to obtain the maximum of heat in the boilers with the minimum of smoke production is also having noticeable effect.

A further evidence of the public interest taken in the subject and in the efforts of the Society is the fact that towards the close of last year (1933) the Secretary of State for Scotland appointed a Committee to consider environmental factors that have a bearing upon public health, and that the Committee had invited the Scottish Branch to appoint witnesses to submit evidence on the question of smoke abatement. The Branch Council appointed Bailie W. Brownhill Smith, the Acting President, and Miss Jack, Edinburgh, a member of the Council, to submit evidence on their behalf, the latter to take up the question from the women's point of view. The inquiry was held in the City Chambers, Edinburgh, and the witnesses appointed by the Scottish Branch appeared before the Committee on 2nd March, 1934. The Scottish Branch have grounds for congratulating themselves in this public recognition of their efforts in the cause of smoke abatement.

THE SHEFFIELD, ROTHERHAM, AND DISTRICT COMMITTEE.

The fourth annual report of the Committee, still the only statutory committee in the country, records the fact that during the year ended March 31st, 1934, the number of chimney observations made totalled 6,956. The lowest average smoke emission was in Sheffield, with 2.7 minutes per hour, and the highest in Rotherham R.D.C. with 4.3 minutes per hour.

There is an important paragraph on research work, in the course of which it is recorded that at the meeting of the Joint Advisory Committee held in June, 1933, Professor R. V. Wheeler stated that so far as metallurgical processes were concerned he was satisfied that such processes could be carried out, with suitable plant, without excessive smoke. He did not think, however, that it could be expected that manufacturers would agree to scrap existing plant which had cost thousands of pounds, and instal new plant.

The Chief Inspector, in his Report, says that the year under review has been the most important one since the Regional Committee commenced to function four years ago. Previously, the Committee had been trying to improve the condition of the atmosphere under adverse trade conditions, but the past twelve months have shown a steady trade improvement throughout the area with a more optimistic view of conditions for the future.

This, naturally, has its effect, and manufacturers, finding that their existing plant is not capable of dealing with the necessary demand for output, have carried out, or are considering, schemes of reconstruction. It is hoped that improved trade conditions will continue, for there is a vast amount of reconstruction work to be done in order that any definite reduction in pollution figures can be shown.

Perhaps the worst type of nuisance, says the Report, with regard to smoke is from heat treatment furnaces. The difficulty arises from the fact that often the maximum temperature carried must not exceed 550°C., so that when using solid fuel a proper ignition temperature is not attained, and unconsumed carbon is emitted as smoke. After considerable investigation, it has been found that heat treatment cannot be carried out successfully without nuisance, where coal is used as fuel. It can, however, be carried out with a minimum of nuisance with producer gas, and is most successful where town's gas is used. The price of town's gas, however, is not competitive with that of coal, in some cases increased cost being 200% greater. There is a type of heat treatment furnace in use—a semi-producer type—which can be worked fairly successfully, but it is not fool-proof nor entirely smokeless. At the present time heat treatment is perhaps the most difficult of all the metallurgical problems that have to be dealt with.

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ELECTRICITY IS THE ENEMY OF SMOKE

Carbon Monoxide Again

House of Lords Discussion.

In the House of Lords on Wednesday, June 20th, Lord Kilmaine called atention to the congestion of traffic in the London streets.

The Earl of Denbigh said that one of the results of the awful congestion in the streets was the harm which was being done by the poisonous atmosphere. There were all sorts of regulations against cars being allowed to emit visible exhaust fumes, but what was the use of such regulations if nothing was done?

Earl Howe said he did not believe that it was realized how much the air in the London streets was poisoned by exhaust fumes. He believed that the medical profession had carried out tests and they had found that there was an appreciable amount—he had heard quite high figures—of carbon monoxide in the blood of policemen who were employed in directing traffic. He believed that in New York they had attempted to tackle this matter and attempted to ventilate their streets through the drains and the sewers.

The Earl of Plymouth, replying to the debate on behalf of the Government, said he would undertake to bring this matter to the notice of the Minister of Transport and he felt sure he would give it his consideration.

The Chief Constables' Association Conference.

The suggestion that a number of unexplained motor-car accidents might be due to carbon-monoxide poisoning following a leaky exhaust was made by Mr. J. H. Dible, Professor of Pathology at Liverpool University, at a recent conference of the Chief Constables' Association at Southport.

The onset of carbon monoxide poisoning, he said, was very insidious, and produced slight changes in mentality and judgment long before consciousness was affected. Just as a man who had taken alcohol lost his judgment long before he was drunk, so a person driving a motor-car with a leaky exhaust might well have his judgment and driving capacity affected before he was physically incapacitated.

Fatality at Twickenham.

The death of Mr. W. H. Woollett, of Twickenham, who died at the wheel of his car, was declared at the inquest to have been caused by a goitre, accelerated by carbon monoxide poisoning from the exhaust pipe. P. C. Hall said that a crack in the exhaust pipe was of recent date, and when the engine was working fumes passed from it underneath the car and entered the body.

Danger at Wembley Stadium.

Extraordinary scenes in the motor-coach parking station at the Wembley Stadium on Cup Final Day have been alleged in a letter to the Wembley Council by a firm of motor-coach proprietors. The letter was originally sent to the Commissioner of Police.

The letter referred to Cup Final Day scenes and stated that some 125 coaches were parked under one roof with one exit only. Some 5,000 persons congregated under that roof to find their coaches, with a result that with the slow running of the engines and the gigantic muddle that took place in emptying this car park, the conditions inside the building became unbearable, several passengers being sick and in a peculiar state of stupor through fumes.

Damages for Smoke and Fumes Nuisance.

Before His Honour Judge Austin Jones, at Worthing Police Court, on May 7th last, Alexander Emile Albert Ivor, doctor, of Sun Gate, Offington Lane, Worthing, sued his neighbour, Thomas Samuel Bailey, of The Homestead, Offington Lane, in respect of an alleged nuisance arising from fumes, smoke, and noise. An injunction to abate the alleged nuisance and £20 damages were sought.

It was explained that defendant had a greenhouse which was heated by a fire outside, and smoke, fumes, and soot were emitted from a 10 ft. 8 ins. stack pipe which entered plaintiff's premises.

Plaintiff, in evidence, said the land and his house cost him £4,000. Among other things he had had to treat his baby for inflamed eyes after the child had been put out for the sun.

Mrs. Mavis Ivor declared that "smoke came over in volumes with a S.W. wind," and she had found smuts on her child's face. Corroborative evidence was given by Edith Cunningham, a maid, and other witnesses.

Defendant, a retired motor engineer, said that the greenhouse and stack pipe were in use when plaintiff bought the land from him and all the time the house was being built. There was no cause for complaint, and even supposing there were, plaintiff was to blame for building his house in the position he did.

His Honour said the case in regards to the alleged noise was not made out, but in regard to the smoke and fumes nuisance there would be £10 damages with costs on Scale B and an injunction to restrain defendant from allowing smoke or noxious fumes to penetrate plaintiff's premises.

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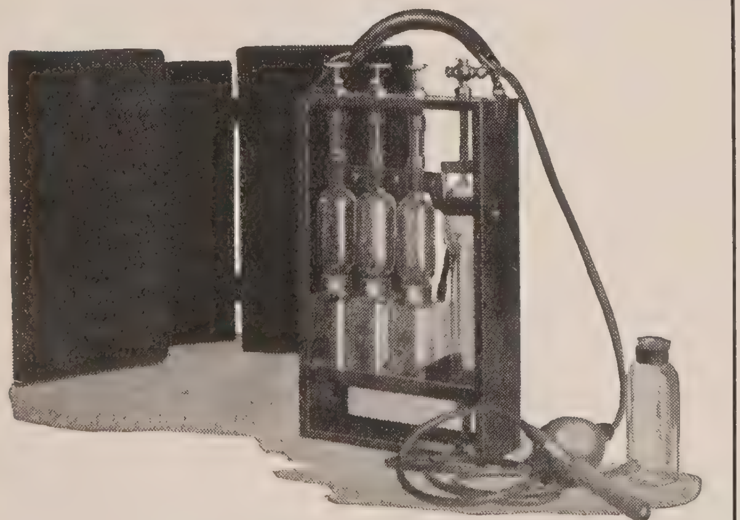

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Smokeless Open-Grate Fuels

Summaries of the Papers read at the Recent Symposium.

Eight papers in all were read at the meeting held in London on June 8th, and they are being printed in full, together with the discussion, in pamphlet form at the price of 1/- each, or 9/- per dozen. They will be obtainable shortly from the Society at 36, King Street, Manchester, 2. The following are much curtailed summaries of the papers and must not be taken as complete in themselves.

Natural Smokeless Fuels. By ED. K. REGAN, M.Inst.F.

The average householder has little interest in smoke abatement, nor is this stimulated when he is invited to use smokeless fuels. Many such fuels suffer from inherent disadvantages or are difficult to obtain. Their popularity among small users is mainly due to the convenience of obtaining a supply of fuel for a small outlay.

The average user has fixed ideas on the subject, and may even complain that with certain classes of coal the use of a poker is unnecessary. It is not understood that a coal which produces a long flame is most likely to sustain the highest loss due to unburnt hydrocarbons with the production of smoke and deposition of soot in the chimney. The open fire probably represents one of the most primitive and crude methods of burning fuel, coupled with a low efficiency of combustion and heat transference.

The open fire should, and does, transfer heat to the room principally by radiant heat transmission from the fixed carbon, which is the most effective form of heat transference. From the dual points of smoke emission and efficiency, the ideal fuel will be that which gives the lowest volatile content concomitant with easy ignition and flexibility.

The Welsh coals ranging from 10% to 13% volatile are well known for their efficiency and adaptability when used in closed and semi-closed stoves. They have a high carbon content, are most effective in radiant heat transmission and as they possess very little or no caking characteristics, they produce a fire which requires no attention in the form of breaking-up or handling. The "opening-out" characteristics of these coals which develop the residual carbon into an irregular shape, assists in maintaining a regular air supply through the fuel mass and produces an extremely high temperature.

Experiments to ascertain the performances of such fuels in open fires were then described, and it was shown that under very ordinary conditions a low volatile Welsh coal gave excellent results as regards smoke emission and heating effect, and in addition, required considerably less attention than ordinary high volatile domestic coal. Similar tests on a kitchen range of the Triplex type were also described.

Practically smokeless conditions are obtained in the next group of fuels, say from 13% to 18% volatile. This has a slight caking index and the fixed carbon possesses the same characteristic "opening-out" during combustion. Here again the radiant heat transmission reaches a high factor, whilst the slightly higher volatile content results in somewhat quicker ignition under extreme conditions.

Smokeless fuel of the classes under discussion are most effective when used in sized form, as size is also a definite factor in smoke prevention. A fire built of sized fuel permits a more regular distribution of air through the fuel used. Graded fuels have the advantage in that they can be purchased ready sized for the particular use for which they are required, and they also possess the added advantage of handling and storage.

Graded Gas Coke. By E. W. L. NICOL, Assoc. I.C.E., A.M.I.E.E., F.Inst. Fuel.

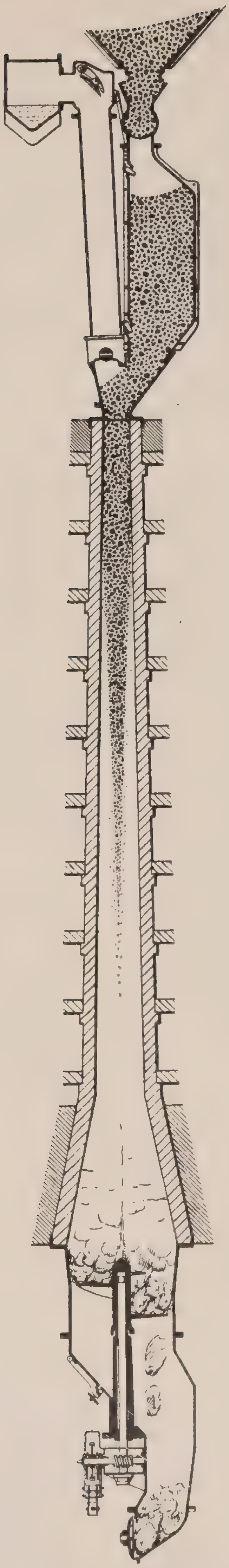
The economic production of a smokeless fuel requires the disposal of the liquid and gaseous products of the process at remunerative prices, and the maintenance of a balance in the demand for gaseous and solid fuel products. In the gas industry there is no reason why this should not be maintained in the future as in the past. The questions of seasonal demand and small storage accommodation, with problems they caused, had been largely overcome by the gas industry.

Heat for domestic uses is required for several purposes and these cannot be satisfactorily met by any one type of fuel. Gas and gas coke fulfil all the required conditions, including smokeless combustion and national economy—gas for cooking, occasional heating and hot water supply; coke for open fires in winter, central heating and continuous hot water supply. Coke is not in competition with gas but is a relatively cheap complimentary fuel for continuous heating.

That coke has not been more widely used in the past was due to the absence of suitable appliances and of adequate grading. Both of these have now been largely overcome. The difficulties of free burning in the open fire and ignition have also been overcome. A widespread bottom grating in the grate is the one essential feature for a satisfactory fire. The combined gas fire and open coke grate is a development that appeals to many.

The rate of progress was briefly considered and it was shown how the sale of coke and of the gas-ignited coke grates was increasing.

Our Solution of the Smoke Problem....



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Low Temperature Carbonization Fuels. By COL. W. A. BRISTOW, M.I.E.E., F.R.Ae.S.

For the greater part of the year in this country it is essential to have some form of artificial heating, which may be obtained by raising the temperature of the air or by radiation. It is the latter, positive, form of heat that should be produced and utilized for the warming of human beings and may be carried out by means of open fires or by gas or electric radiators. Only a small part of the energy of a solid fuel in an open grate is transmitted to the room by means of radiation and convection. A close, heavy coke will burn more slowly than a lighter and more reactive coke, but the heavy coke will radiate at half the heat intensity of the other. The factor of *rate* of giving up heat is also limited with the question of ignitability, one of the most important properties of any fuel. A gas coke usually requires 4,500 B.Th.U.'s. to ignite, whereas a good fuel made by the process of low temperature carbonization may need only 1,000, or even less B.Th.U.'s.

The calorific value of these fuels is as good as, or better than, first-class house coal. Being more efficient heat radiators than coal a low temperature fuel will transmit into the room, for a 14,300 C.V., some 4,719 B.Th.U's. compared with 3,146 B.Th.U's. from a coal of the same C.V. The gain of 1,573 B.Th.U's. on each pound is 50% above the coal figure.

The advantages of this type of fuel are that it is practically smokeless, ignited more readily than any other kind of carbonized fuel, burns up rapidly, always maintains a high degree of radiation efficiency, emits 50% more radiant heat than coal, and emits beneficial infra-red rays.

The therapeutic value of these rays was discussed and their value in the cure of chronic rheumatic conditions, lumbago, sciatica, etc., was mentioned.

So far as the fuel is concerned the problem is already solved, but there still remains something to be done in the designing of grates. The paper concluded with an examination into the design of the ideal grate for the burning of smokeless fuels.

Coke-Oven Fuel. By H. CERCKEL.

Carbonization is done at the lowest cost when done in coke ovens, but it is impossible to build ovens of one type producing both high and low temperature coke at will. There should be two types of ovens at the same plant—some producing high, others low and medium temperature coke.

Oven coke can be used as a household fuel under certain conditions and with care. Low or medium temperature coke is preferable, being more easily ignited, and when it contains 7% to 10% of volatile matter a pleasant fire is obtained. A coke more reactive than furnace coke is desirable, as combustion is more rapid, the pieces of coke move about, and the coke being more porous the ashes produced do not cling to the pieces in the same tenacious manner.

Coke for domestic use should not contain more than 6% of ash, and should be graded with great care and precision. The percentage of volatile matter should vary according to its use.

The blending of coal for high temperature carbonization is practised regularly on the continent, and many experiments have been carried out at coke ovens in this country.

The Lecocq Company have made tests over a period of years on poor coking coals for the production of household coke, and particulars of these tests were given by Mr. Cerckel. Highly reactive medium temperature cokes are obtainable, and a number of English coals have been tested. The fact that existing ovens can be adapted to this process by re-building the walls open up great possibilities.

From the Housewife's Point of View. By MRS. G. H. MILES.

The experiences and opinions advanced were either entirely personal or gathered from housewives living in similar conditions. The burning of coal has greatly diminished during the last twenty-five years. In her own home there was only one open fire, on which smokeless fuel had been used, not altogether with success. Other experiences with coke and "Coalite" were given and were followed by an examination of the qualities required in a domestic fuel—economy of price, cleanliness, ease of lighting, burning, and maintenance, and cheerfulness.

The last point was stressed—there was a demand for a fire to be "living."

Development and Marketing. By DR. G. E. FOXWELL, F.Inst.F., M.Inst.Gas E.

Smoke abatement was only possible through a policy based on economic and business principles. The London Coke Committee had shown what could be done by co-operation, and their methods were a guide for future reference.

The paper sketched the present lack of co-ordination in marketing and the subsequent confusion of products. "Reviewing the processes available, high temperature, medium temperature, and low temperature, some using highly coking coal making a hard coke, some using a poor coking coal making a combustible coke, others using scientifically blended coals, we can only anticipate a confusion of products."

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cost of marketing will then approach 100 times the cost of dealing with them all through a central organization. Before we reach this condition cannot we pause and bring order? Cannot all solid domestic fuel be marketing under a single organization—or at least under two organizations, one dealing with high temperature coke and the other with high volatile open-grate coke?

Dr. Foxwell concluded by summarizing his findings in categorical form as follows :—

(1) The Society should attempt to bring about co-operative marketing of the gas coke and coke-oven nuts for the whole country.

(2) The Society should endeavour to regulate the sale of open-grate high-volatile coke preferably by arrangement between producers or possibly by Act of Parliament to lay down certain grades which coke must be described whenever offered for sale.

(3) Producers everywhere should be encouraged to reduce costs in order to reduce prices to attract the great mass of potential consumers who regard price as their only criterion. If the price had to be increased later, the excellence of the material would be the best guarantee that the customers would not be lost.

(4) Producers should give great attention to the quality of the coke desired by the public. This applies to every class of coke. There are few cokes that could not be immensely improved by better pretreatment of the coal, blending and other aids which modern scientific research has placed at our disposal.

(5) One further point which would assist the development of solid smokeless fuel is that production should not be unregulated so that companies that start to manufacture and fail to secure adequate markets lose their capital. That is the nineteenth century way of business, and is definitely uneconomic. It has brought carbonization to the verge of being a by-word among capitalists. The central sales organization could presumable, if sufficiently strong, control production as the Central Electricity Board will do for electricity; the alternative appears to be the creation of local monopolies similar to the present arrangements governing the supply of gas, which certainly work very well.

Properties Required in an Open-Grate Fuel. By JOHN ROBERTS, D.I.C., M.I.Min.E., F.G.S.

Raw, smoke-yielding coal is an immature product that nature very providentially left in a half-finished state. Providentially because if it had been converted into a smokeless fuel vast quantities of condensable vapours and permanent gases would have been lost in the process. Nature has not been entirely improvident, and it behoves us to see that the energy which she has stored up for millions of years is employed to the greatest advantage, and not needlessly wasted as is being done when immature coals are burnt in the raw untreated state.

The use of smoky coal in the domestic grate is accompanied by serious disadvantages. It produces smoke, soot, and smuts which not only foul the atmosphere, but creates a good deal of nuisance in the home. Too great a proportion of the heat passes up the chimney when high-volatile, long flaming fuels, are used. Thirdly, the production of smoke is a source of loss of heat energy. Smoky coal is a very inefficient fuel.

The properties required in smokeless fuels were then discussed and were summarized as follows :—

(1) The fuel should be smokeless.
(2) It should be readily ignitable.
(3) It should burn vigorously.
(4) It should give high radiant efficiency.
(5) It should be robust and conveniently sized.
(6) It should be reasonably dense and compact.
(7) The volatile content should be between 3% and 20%.
(8) It should have low ash and moisture content.
(9) It should call for a minimum of attention during combustion.
(10) It should have a good cell structure, which should be reasonably uniform.

From the National Viewpoint, and Conclusion. By DR. E. W. SMITH.

The concluding address, given extempore by Dr. Smith, was short and can be given in full.

Economy, said Dr. Smith, has been defined as correct spending, and the national economy therefore demands the correct use of fuel. This entails the complete carbonization of coal, by means of which wealth will be created and amentities will be improved. This is what smoke abatement seems to do, and it is thus all in line with national economy.

There is no doubt that smoke elimination will mean better health and a higher industrial output. Both agriculture and horticulture will be assisted by clean air, both in the quality and the quantity of production. It will mean that the home output of agricultural produce will be stimulated, which is a direct economic benefit to the nation. The elimination of smoke will assist the national economy in such things as laundrying and buildings.

But will the mining industry be assisted? This is a more doubtful question. It is clear that there cannot be a 25% reduction in the weight of smokeless fuel consumed, in comparison with the weight of coal it has displaced, and, at the same time, give rise to a large increase in the output of coal.

The difficulty of smoke abatement is not in the public, but in the individual consciousness. Every person feels that it is a problem that can only be solved by someone else, and that his own part makes no appreciable difference. The only way is to make people feel that it pays them to adopt smokeless methods.

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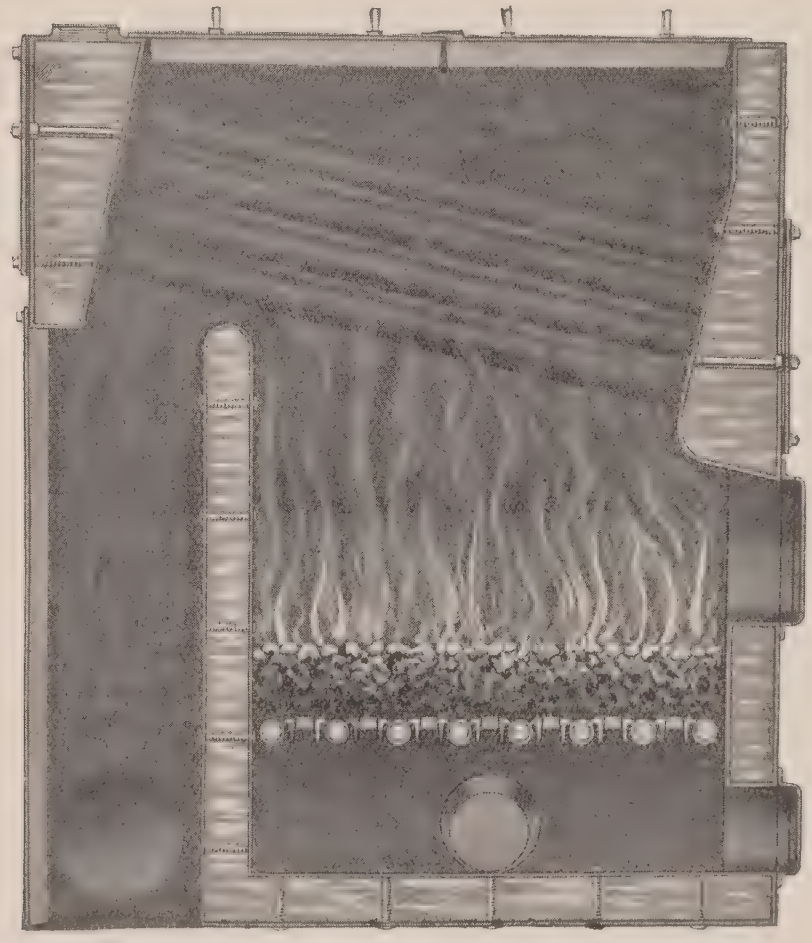

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It is to be regretted that the symposium has not kept more definitely to its subject of open fires and solid fuels. The question to-day has been not how can all domestic requirements be achieved, but how can the open fire be made smokeless?

Mr. Nicol was positive on the uses of coke and the criticisms raised are accounted for by variations in coke qualities. It is doubtful whether it will ever be possible, for economic reasons, to produce gas cokes of similar quality to low and medium temperature fuels.

There is actually no necessity for the gas industry to produce the perfect solid smokeless fuel. 8,000,000 tons of coke are produced each year, but of this quantity only one million tons are available for domestic purposes; the other seven millions are used for industrial purposes and for closed boilers. There are 40 million tons of coal used in the open fire. There will not be enough gas coke available for domestic purposes, and it is therefore necessary for Colonel Bristow and others to develop, by other methods, solid fuels to replace the use of coke in the open grate.

It would pay a large number of collieries to support the smoke abatement movement, at least for the next 30 years. By that time the question of labour-saving will have become the most important of all. The outlook of young people is different from that of the older generation, and they do not care for open fires like the older people. They try to eliminate all that goes with housekeeping. The girl of to-day is not keen on domestic life, and as the woman of to-morrow she will have only the best in labour-saving. This means that the future will lie with either gas or electricity.

Concurrent with this demand for labour-saving it will be necessary to have more satisfactory ventilation.

There will be, for many years, an increasing demand for solid smokeless fuel, but ultimately gas or electricity will be universally used.

Everywhere the Same.

" A resident in the Murrayfield district, I frequently walk over Corstorphine Hill in the forenoon, and I am astonished when glancing southwards to see dense clouds of black smoke which issue from a number of tall chimneys. At times the discharge hangs like a pall over the entire neighbourhood."—*Correspondent in Edinburgh paper, June 6th.*

" Sunday: What a glorious day! And what a tonic to minds and bodies worn with all the anxieties of these difficult times! How beautiful everything in Nature looked, even only a little way from the city!

" And then Monday morning—and the smoke pall! Gazing over the town, and wondering what it might be like if only we had the sense to use our coal in anything approaching a rational way, one could not help thinking that surely there must be many others who would prefer not to continue this wicked waste, or to aid in the blasting of Nature's beauty and the cruel sacrifice of life and health associated with the 'diseases of darkness'."—*Correspondent in Sheffield paper, June 7th.*

" My *Times* for May 18th has just reached me here (June 11th) and in it I find an explanatory letter on smoke abatement. A subject of perennial interest, and of world-wide interest, too, it would seem. Here it is a magnificient day, not a single cloud obscuring the blueness of the sky or marring the majesty of Table Mountain. I have been sitting on the deck of this steamer the whole morning directly in face of the mountain, and not for five minutes during these four hours has the mountain been clearly visible. Dense masses of smoke have poured without ceasing from factory chimneys and ships' funnels, transforming one of the loveliest and most characteristic views in South Africa into a scene like a 'fogged' photographic plate."—*Correspondent in the " Times," July 6th.*

At a recent meeting of Lambeth Council, Councillor Simpson regretted that the Public Health Committee had decided not to send a delegate to the Conference of the National Smoke Abatement Society, urging that the subject was of importance to every citizen. He hoped the committee in future would recommend sending a delegate.

Councillor Barton invited members of the Council to come with him to Vauxhall to see the effects of smoke emission, and Councillor Green, in endorsing this, hinted that Surrey lost their match with Essex the other day because of the smoke that descended upon the Oval (laughter).

" It seems absurd that we in Manchester should be spending hundreds of thousands of pounds a year in treating diseases that are largely due to air pollution and at the same time not taking any definite measures to remove the cause."—*Alderman W. T. Jackson, of Manchester.*

" Another factor in the campaign for fresh air and sunlight is smoke prevention. Without increased smoke abatement we might lose the value of the great re-housing movement. Systematic inspection has lessened the evil of smoke from factories, but the chief evil now comes from thousands of domestic chimneys. the vitiation of the air is appalling. At a London station there was found to be in 1932 a deposit of 107 tons of sulphates to the square mile, and in Bradford in the same year there was a deposit of 22 tones of tar to the square mile. These tonnages show that urgent action is essential. The burning of raw coal should be lessened by all means in our power."—*Dr. Stanley H. Badock, Pro-Chancellor and Treasurer of the University of Bristol, addressing the Congress of the Royal Sanitary Institute.*

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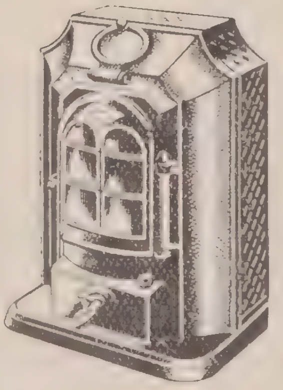

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The Journal is open for free discussion of all aspects of the smoke problem, and the opinions expressed in contributed articles are not necessarily the same as the views of the Society. Quotations and abstraction of matter appearing in the Journal is welcomed, provided the usual acknowledgements are made.

COMMENTARY.

THE Sixth Annual Conference has done its good work, but the impetus it gave to smoke abatement activity will go on for a long time. Glasgow was, in many ways, a record meeting, and, as it began the day after the launch of the "Queen Mary" it was perhaps only right that it should be. Thanks to the keen interest of the Scottish members and delegates the attendance was the highest yet, and thanks to the excellence of the material provided, the press reports were more numerous than on any other occasion. Two important resolutions were passed, and as these are to be circulated to local authorities throughout the country, many local discussions on the subject may be expected during the next month or two. These resolutions are given elsewhere in this issue, together with a member's descriptive account of the Conference. The papers are not reprinted here, but will appear in the *Proceedings of the Glasgow Conference* (1/-), together with the interesting discussions that followed them.

The Society's most important publication of the year has recently been issued. It is "A Treatise on the Law Relating to Smoke and Noxious Fumes," by the late Mr. Randolph A. Glen. Mr. Glen's name is familiar to all members, for he was both our Standing Counsel and had for many years been an active and invaluable member of the Council of the Coal Smoke Abatement Society. In local government circles everywhere he was well-known as the editor of Glen's Public Health and as the foremost authority on all local government legislation. For many years the standard reference to the smoke abatement law was a pamphlet by Mr. Joseph Hurst, but this was rendered out-of-date by the passing of the 1926 Act. Mr. Glen very kindly undertook to prepare a new treatise for the Society, and actually wrote the greater part of it, in pain and with difficulty, during the illness that, unhappily, was to be fatal. The treatise is preceded by an introduction and appreciation by Sir Lawrence Chubb. It is published at one shilling, and already a gratifying number of copies have been purchased, largely by local government officials. A review of the treatise by Mr. Charles Gandy is published on another page.

Readers who live in districts in which the local authority has taken over the former E.M.B. poster frames for health propaganda and is co-operating in the scheme of the Central Council for Health Education, will see the Society's striking smoke abatement posters in position during December. These are bold, contrasting designs, symbolising the difference between smoky and smokeless conditions, with brief letterpress statements on the two smaller sheets. A folder bearing a photograph of the set in position will be published in the Annual Report, a publication which will be seen by most readers of the Journal.

It will be with regret that members and other readers who know the history of the Society will learn that Alderman Will Melland is no longer the Chairman of the Executive. At the first meeting of the Executive after its re-election at Glasgow, Alderman Melland declined to be nominated for the position he has occupied for ten years with the confidence of all ; a confidence that has been more than justified by his skilful management of affairs and the steady growth of the Society. Mr. Melland, as those who know him are aware, is an exceptionally busy man, and it is perhaps only fair to release him from a position which at first he took only as a temporary measure. And the Executive, in so releasing him from the Chairmanship, have cleverly made it more difficult for him at any time to find an excuse for trying to resign the position of Hon. Treasurer. That would be much more serious and could not be contemplated, for Alderman Melland excels, not only in the gathering of money, but also in the spending of it wisely. Which is more than one can say of some Chancellors of Exchequers.

The new Chairman is Mr. Charles Gandy, who is well-known to members in Manchester and to those who attend the Annual Conferences. It will be remembered that he was the joint author, with Mr. R. H. Clayton, of a valuable paper at the Sheffield Conference. Mr. Clayton, in proposing Mr. Gandy's election, said that he was one of the few who had an entirely clean sheet—that he had no interests, direct or indirect, in anything that could be suspected of having any ulterior motive in smoke abatement. Mr. Gandy, who is a barrister, and who contributes in this issue a review of Mr. Glen's treatise on legislation, humorously replied that his chief qualification for the position seemed to be in having no qualification at all. The truth is, of course, that Mr. Gandy is qualified by an idealistic and yet practical enthusiasm for clean air and clean cities, and by many years of active participation in our work. The Society continues to grow and its activities to broaden, so that its new Chairman will not find his position a mere sinecure. We believe that all readers of the Journal will join in extending to Mr. Gandy good wishes for a happy and profitable experience in the task he has undertaken.

Readers will be receiving a copy of a new pamphlet "The Smokeless Home," which will explain, in a brief description, the ways and means of abolishing domestic smoke. We shall be glad to send copies to any friends of theirs who are known to be in need of one, on receipt of the names and addresses. Quantities for distribution in bulk may be obtained at the rates of 1000 for £5, 500 for £2 15s. 0d., and 100 for 12s. 6d. We hope that Health Departments and others interested will help to spread the circulation of what is an attractive and practical little publication.

Glasgow

A smoke abatement conference with no controversy about a Sunday meeting! That is one of the chief impressions of the Glasgow meetings, and is simply accounted for by the fact that there was no Sunday meeting: our Scottish hosts demanded as much as possible of Saturday for our entertainment, and so made it necessary to take the whole of Friday for meetings. This made a Sunday session unnecessary, and by general approval it was agreed to keep to this new arrangement at subsequent conferences.

The conference seemed to go off smoothly, and judging by the numbers present, and by the interest taken in the papers and discussions, it was of practical value to the majority. There were many new faces, mostly Scottish ones; and the Council Hall re-echoed with the rapid burr and rhythm of the Scots' tongue that — rather surprisingly—is so pleasant, if a little difficult, to the English ear. One noticed in particular a Councillor from Edinburgh who was suspected to be interested in electricity, a Councillor from the Midlands who seemed interested in everything, and a familiar Councillor from Glasgow, who, one suspects, tries to appear fiercer than he really is.

Glasgow is hospitable and royally looks after those who visit her at congresses and places where they meet. The cynical might say that this is a subconscious reaction to the deplorable Southron impression of the canny Scot, but in all probability it is simply because Glasgow likes doing it and cannot help it. The reception on the Thursday evening was more enjoyable than a reception has the right to be. Lord Provost Swan presided, and the ice was well broken by his kindly charm and appropriately worded address. He obviously knew what smoke abatement was, and what we were conferring about. According to some the concert in the Council Hall was as good as the running buffets that were not neglected, and according to others the dancing in the great banqueting hall was as enjoyable as the eightsome reel, which the English visitors watched with interest, was energetic.

REJOINING THE COACHES AFTER LUNCH AT CALLANDER

The Trossachs.

If an Englishman, in his ignorance, ventures to ask of a Scot " What *is* a Trossach ? " he is met with a pitying look. Apparently fearing such a poser from the Conference, the Glasgow Corporation hauled us out of our meeting place at eleven fifteen on the Saturday morning, and took us, eight bus loads full, to see the Trossachs for ourselves. We were quickly out of the murk of the city, past the sprawling outer suburbs, and seen into a fair green countryside with the mountains, the outposts of the Highlands, rising into the grey clouds that hung low ahead.

At Callander, beautifully set among the earliest hills, we lunched. It was a perfect lunch, and that is all that need be said. Bailie O'Hare welcomed us on behalf of the Health Committee, Councillor Elger on behalf of

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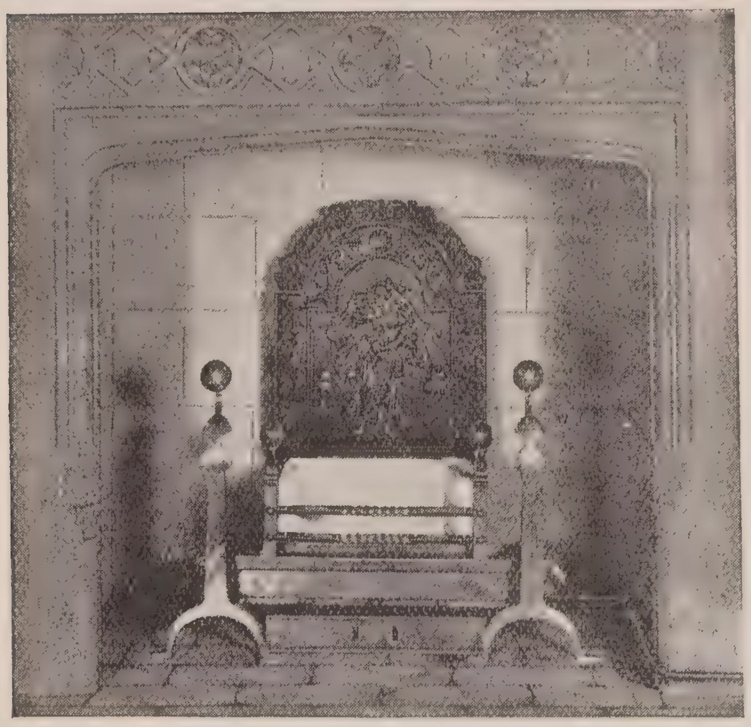

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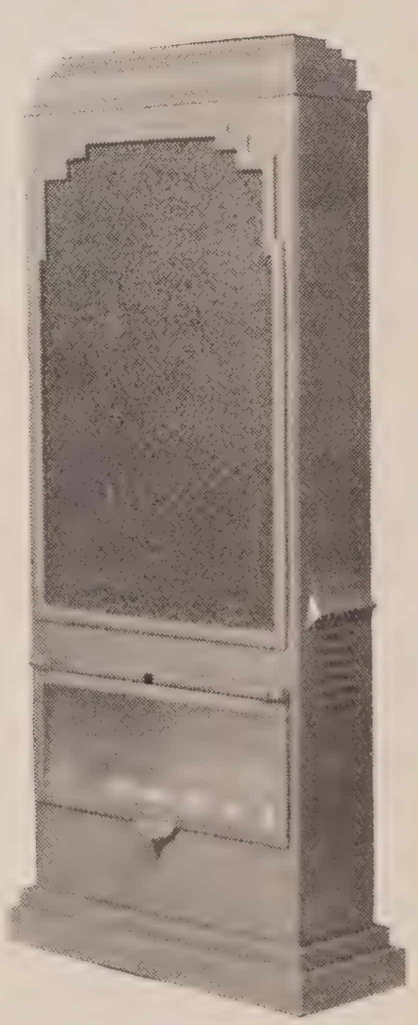

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How we all packed into the little fleet of boats, including a steamer, motor launches, and a cattle boat that held quite a large number, is a mystery. But we were all embarked, and after an hour's idyllic sail along the length of that magnificent Loch, surrounded by hills afire with all the colours of autumn, we arrived at Stronachlachar. Stronachlachar was a sore temptation to many of the Scottish delegates, especially those exiles who have only such words as "Hunslet" to speak, and they said it at every opportunity simply for the enjoyment of its deep clanging syllables. At the place aforesaid, we were welcomed by high towers of sandwiches, scones, and tea.

After that welcome refreshment—the loch was cold—we returned by the boats to our buses, gave a last look at Ben Lomond, and other giants in the far distance, tried to defend the beauty of the English Lakes from bus drivers jealous of Scotland's pre-eminence, and set off for Aberfoyle. The road wound and zig-zagged over the hills—the Duke's Pass—gave us a glimpse, far below, of lonely Loch Drunkie, which has a legend of illicit distilling, and at last dropped us, with the dusk, into quiet Aberfoyle.

There we were astonished to find another tea, more towers of sandwiches, and more real Scottish scones, waiting for us. It was nine o'clock when we finally alighted in George Square, and suddenly realized that the Conference was over. We were tired and felt that our enjoyment of the day was as perfect as it could be, except for the not unimportant disappointment that after all no one had pointed out a Trossach to us.

The Meetings.

Little space is left to consider the meetings, which, after all, were the purpose of the Conference. However, they are all given in full in the more serious *Proceedings of the Glasgow Conference.*

Dr. Owens was listened to with the close attention that is due to him for the invaluable work he has done for measuring atmospheric pollution and for organizing the scheme for standard observations that now convers every important area in the country. His paper was authoritative and important and one hopes that he sensed the real appreciation of his audience. The demonstration of the smoke meter, which is only one out of a host of practical "Owens" inventions, was audibly appreciated. After the many attempts to measure the smoke as it emerges from the chimney, ranging from optical instruments to charts and screens, Dr. Owens' meter seems to be the right thing at last.

Mr. Oliver Cochran had a subject that has been discussed only once before—the dangers and difficulties that smoke adds to flying. Aviation, he said, would demand the cleansing of the atmosphere for its own sake, and we all wished that it would assert, as Mr. Cochran so eloquently did, its requirements. But the airman, perhaps, although he dreads smoke fog and hates the wretched visibility of our towns, looks upon smoke as so many people do—not as a remediable evil but as an unfortunate necessity. Here then, is there opportunity for the enlistment of an important and growing body of opinion—the air people. Dependant so much as they are upon visibility they must already be smoke minded ; it is only a step further to make them *smoke abatement* minded. A further important point that arose—of a coercive nature if you will—was that the cities that neglect the cleaning of their skies will perforce be avoided in the coming extensions of inland air routes. Clean air is as necessary to the airports of the future as deep water is to the seaports of to-day.

In the afternoon the Scottish Branch held its own session, with a paper and demonstration by Mr. William Besant of the Glasgow Parks, and an address by Bailie W. Brownhill Smith. Mr. Besant showed the effects that smoke has upon vegetation, not only by word, but by a dramatic exhibition of the trees and shrubs themselves. There were sturdy green firs from Loch Lomond and stunted, shrivelled specimens, of the same age and stock, from the city. Smoke, to those who love trees and flowers, is the cause of constant and helpless anguish.

Bailie Smith's paper reiterated his well-known arguments on the methods of gas production and distribution, and naturally provoked a lively discussion among the protagonists of smokeless fuels.

There was only one paper on Saturday morning, but it was a most important one. Dr. Jervis had many pertinent things to say about the close relationship between housing and slum clearance and smoke prevention. The appalling indifference to smoke abatement of those who are concerned with housing and re-housing and the building up of the new slum-free cities, shows how far the movement has yet to go in creating a responsible public opinion on the subject. Dr. Jervis's paper ought to be read by every person, from the Minister of Health downwards, who is concerned in any way with housing.

It was a pity that the discussion did not reach anything like the same high level. To be fair though, the discussions throughout were excellent and informative. Let us hope that everything at Bristol in 1935 is as productive and as practical as were these meetings in the Glasgow Council Hall.

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A World of Dust

Dust. By S. CYRIL BLACKTIN, D.SC. M.SC., B.SC., PH.D., A.I.C. CHAPMAN AND HALL, LONDON. Price 18/- net. pp. 296.

This is surely the most complete and exhaustive treatise on dust in all its forms that has ever been planned, and it is likely to remain the standard reference book on the subject for many years to come. It examines every kind of dust in every ramification of its nature and effects, and reveals the enthusiasm with which Dr. Blacktin has studied and collected an immense amount of data on a subject that he has now made peculiarly his own.

The scope of the book can best be illustrated by the chapter headings. In the first part dust is considered generically—in general, in nature, and in everyday experience. In the second part dust is considered in specific spheres—in the experimental sciences, in geology, in botany, in industry and technology, and finally in pathology and physiology.

Dust arising from combustion and the smoke nuisance in general is considered, the whole field being surveyed rapidly and in a rather congested way. Our special subject is not taken separately but is dealt with as one of the many types of dust met with in everyday experience. Some of the other factors that thus contribute to atmospheric pollution will be new to many students of the smoke problem and will be found to be of considerable interest. The importance of many of them, however, is negligible when compared with the dust and dirt arising from the combustion of coal.

Some of the author's references to smoke abatement matters are taken from what are themselves only partial references to the original source of the information. Thus the only mention of the important investigation on the distribution of the smoke of Norwich around that city (17th Report of Atmospheric Pollution, D.S.I.R.) is a press report of a reference to this made by Dr. H. A. Des Voeux at a conference of the National Smoke Abatement Society. Again, it is stated that E. D. Simon and M. Fitzgerald estimate that household washing, in Manchester, were that city as clean as Harrogate, would be reduced by £250,000. This estimate was, of course, made by an Advisory Committee of the Manchester City Council, and was only quoted by the authors mentioned in their book "The Smokeless City."

The chapter on dust in pathology and physiology is a very valuable survey of a serious, and still largely unsolved, problem created by industry. The variety of dusts created is considerable and the effects that they have upon those working upon the materials responsible are frequently highly dangerous and always unpleasant. The general term for this subject, adopted by the International Conference on Silicosis in 1930, is "pneumonoconiosis," which "covers all work dealing with harmful physiological effects due to dusts in general, and lays special emphasis on silica dusts or derivatives of silica."

"Dust" is such a valuable work that one is disinclined to be unduly critical, but it is difficult not to protest against the author's unfortunate and indigestable syntax. In places the book reads as if it were the literal translation of a hasty summary of a work in German. The following extract (p.74) deals with an interesting and important truth, but, with all deference to Dr. Blacktin's scholarship and erudition, could it not have been made a little easier to understand?

"In west wind countries" begins the paragraph, "e.g. England, a general west to east dust movement —with slight direction variation from summer to winter—will obtain. Locally this spells general east-end city dust disposition which determines sociological population distribution. For industrial dust-producing units are operated in east and south-east, where their own, and western, domestic smokes are added and deposited. West to east dust distribution is, therefore, most marked, witnessed by the most noticeable bouleversement when, occasionally, wind reversing direction, city-dirty east end air assaults the west. This dust distinction—vast, since cumulative—often markedly characterises dwellings and habitants from east to west, largely explaining physical health, mental attitude and outlook contrasts, and producing political repercussions. C. M. Smith states a 5% higher pneumonic death-rate amongst poor class people in Glasgow than the city rate, whilst pneumonia causes more deaths than any other acute affection in this country."

And finally, when it is stated that "In Book II. of the 'Iliad,' Homer (109) says . . . " so that one looks up reference number 109 in the author index, to find only the words "Homer. 'Iliad,' Book II." one is inclined to feel that even indexing can be done a little too thoroughly.

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Health.

I should not be surprised if, owing to the great attention which has been given to certain complaints, some Hon. Members thought that the most fatal diseases were tuberculosis and cancer. That is very far from being the case. Easily the first in their fatal effects are those diseases which are classed as respiratory diseases—pneumonia, bronchitis, and diseases of that kind—and I am afraid that we must attribute the very high mortality which we suffer from these diseases to the congested conditions and polluted atmosphere which are to be found in our largest towns.—*Mr. Neville Chamberlain, as Minister of Health, House of Commons, June 28th,* 1923.

More people are devitalized, disabled, and poisoned by the impurities contained in smoke-polluted air, than by the noxious ingredients in food and water.—*Mellon Institute of Industrial Research, Pittsburgh.*

Vegetation.

Summary of effects of polluted air upon vegetation :

(1) The cloud of smoke blocks out the sunlight, and thus reduces the available solar energy by, in some cases, as much as 40%.

(2) The thick deposit on the leaves of plants and trees still further blocks out the light.

(3) The choking of the stomata by the tarry, glutinous matter tends to asphyxiate the plant, and effectively to check its power of assimilation of carbon dioxide.

(4) The presence of free acids in the air tends generally to lower the vitality of the plant.

(5) The free acids on the soil make it sour, and thus limit the activity of the soil organisms, which must work freely if the soil is to maintain its fertility.—*A. G. Ruston.*

Weight of lettuces grown in Leeds districts compared with the atmospheric deposit :—

District	Deposit (Gms./acre)	Total Weight of Crop. (Gms.)
Garforth (outside are	—	175
Weetwood Lane	147	140
Headingley Hill	273	120
University	399	104
Park Square	847	56
Hunslet	1565	44

—*Cohen and Ruston.*

Vegetation in U.S.A.

The few evergreens still living in the Missouri Botanical Garden make nothing like the growth they should, some of them apparently making no progress from year to year, and, of course, these eventually succumb. Experience has shown that it is less and less possible to grow plants satisfactorily in localities where, before the growth of the city, they flourished. At the Missouri Botanical Garden you will find nothing but a few soot-covered specimens of pines and yews, and in other gardens, differently situated, they would be a disgrace. . . . . A few years ago, during the month of November, hundreds of plants in the greenhouses at the Garden were practically killed by the action of one particular smoke cloud—*The Director of the Missouri Botanical Garden.*

Economic Consequences.

We would observe that the three million tons of soot which it is estimated by the Committee on Smoke and Noxious Vapours Abatement are discharged into the air annually, are equal in weight to nearly three days output of all the collieries of Great Britain. In effect, the work of over a million men for three days every year is devoted to providing the soot which pollutes our atmosphere—*Report of the Royal Commission on the Coal Industry,* 1925.

On the financial side of the question a number of architects estimated that a clean atmosphere would reduce the cost of the upkeep and maintenance of buildings by as much as 50 per cent. Other, more cautious, said from 15 per cent. to 20 per cent., but none denied that considerable savings would be affected.

Property owners were asked to estimate the yearly cost of outside painting and repairs in the case of a residential property in the city rented at £75 per annum, and to compare it with the cost that would be incurred in the case of a similar residence in the country. Several stated that the cost in the city would be 50 per cent. greater ; others 25 per cent., and one 10 per cent.—*Report of Investigation of the Atmospheric Pollution Committee, Manchester Corporation.*

The Waste of Fuel.

Fuels are destined to become so valuable to the human race that they will be placed only in the hands of those who can, to the greatest advantage, control their combustion. Scarcely anything is more archaic in our civilisation, or more wasteful in the eyes of the economist, than our individual house-heating systems, in which all but a fraction of the potential heat of the fuel is dissipated upon the outside atmosphere—*Samuel Rea, former President of the Pennsylvania Railroad.*

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Glen's Law Relating to Smoke and Fumes

By Charles Gandy. A Review of Mr. Glen's Treatise.

To every Lawyer, and to all concerned with the administration of law by public authorities, the name of Glen, in relation to Public Health, has long been familiar. The late Mr. Randolph Glen in editing the 13th and 14th Editions of Glen's Law of Public Health and Local Government, one of the most massive of law books, in two volumes now containing nearly 3,000 pages, was following the steps of his father and of his grandfather, William Cunningham Glen. In an interesting Preface to the last Edition he tells how the latter first published in the year 1848 a paper-covered book of 72 pages dealing with the Nuisances Removal Act of that year, the forerunner of the 1st Edition of "Glen" which, published soon after the passing of the Public Health and Local Government Acts of 1858, collected in a single annotated work of 462 pages all the statutes then relating to public health and local administration. In the growing bulk of each following edition we may trace the ever increasing interest in matters affecting the health and comfort of the people during the last 70 or 80 years.

If in this vast mass of law the references to the increasingly important matter of air pollution seem fragmentary it is through no fault of the late Editor, who was largely responsible for the only Act in the last Edition, the Public Health (Smoke Abatement) Act of 1926, exclusively concerned with smoke abatement, and who spent his last days of illness in the preparation of the little book now published by the Society, of which he was a devoted member. Perhaps in so doing he was pointing the next line of development in the wide field of law to which he and his family have given such exhaustive study. The little book, to which Sir Lawrence Chubb has contributed an admirable foreword, contains in some 18 very readable pages, a full treatment of the present law concerning air pollution, conveniently set out under separate headings of which the first three, relating to smoke as a common law nuisance, and to the law applying to dwellings and to business premises respectively, are perhaps most useful for general purposes; the remaining headings dealing with Railways, Steamships, Vehicles, and the law especially affecting London.

Sad and Inexcusable Waste.

The Author, in a short preface, regrets that, in spite of the activities of the Society, and other factors which should have led to improvement, the state of the atmosphere in our large towns to-day is said to be little better than it was 25 years ago, and refers to "the attack upon our lungs and bodies, our buildings and monuments, and our household and business effects, continuing with dire results and causing the expenditure of vast sums of money to cope with the evil" and to "the sad and inexcusable waste" by "the discharge from chimneys of thousands of tons of valuable by-products." Under the first heading he deals at some length with the Barton Power Station case. He refers to the well known definition of a nuisance as "an inconvenience materially interfering with the ordinary comfort, physically, of human existence, not merely according to elegant or dainty modes and habits of living, but according to plain, sober and simple notions among English people." Surely smoke and dirt, as we experience them in town areas, fall within that definition.

There is much which should prove of interest to members of local authorities in the next two headings, and to those concerned with domestic smoke it is interesting to have the author's opinion that S.10 of the 1926 Act, which gives power to a local authority to undertake and contribute to researches relating to atmospheric pollution and smoke abatement, would enable local authorities to investigate and provide money for investigating domestic fire appliances. He reminds us that smoke from private dwellinghouses, which in the aggregate exceeds the smoke from all other sources, can only be dealt with by legal proceedings if it causes a nuisance at common law, all the statutes at present in force which deal expressly with smoke excluding such premises from their provisions." As to the provisions relating to smoke from business and industrial premises he sets out in detail with convenient references all the relevant sections under both the Public Health Act 1875 and the Act of 1926, and this section of the work will be of great assistance to those who wish to find their law quickly.

It is a matter of regret for the Society, and of sorrow for those who knew him, that the author of this little text book has not lived to carry on his work in the development of this branch of the law. It will be interesting, when a second edition is published, to see how much has been added, for legal text books, as every lawyer knows and as we have seen in the case of Glen's Public Health, put on weight and bulk by the passing of new statutes and the giving of fresh decisions. It is perhaps better that the law should develop in this way, so that those concerned may deal freely with their local problems within the limits of the law, than that the handling of such problems should depend on the dictation of a Government Department. In country districts where "a cottage chimney smokes from betwixt two aged oaks" we may gladly leave Corydon and Thyrsis to decide what fuel shall cook their savoury dinner. In towns, where between factory chimneys thousands of cottage properties or offices are each contributing to shut off the light from one another

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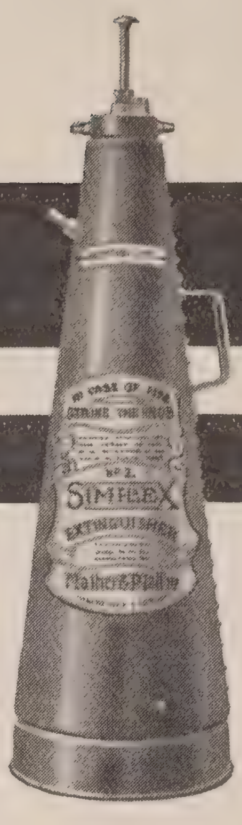

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and cause havoc to health and property by a dense and dirty smoke cloud, it is a different matter. It is, of course, impossible at present to pass a general law prohibiting the burning of raw coal in such areas, as a whole, and in spite of the advantages of gas and electricity we recognize the value of the open fire in the home. Might it not, however, be possible to obtain the passing of a law which would enable local authorities to prohibit the burning of raw coal in any building in future erected within certain prescribed areas in their districts? As the harm done by domestic and office smoke is, generally speaking, much more local than that caused by the lighter factory smoke, the occupants of the prescribed areas would enjoy the benefit of such a prohibition. In a city area, where most of the new buildings are in fact smokeless, the prohibition would cause no hardship. On a selected housing estate it might be an interesting experiment. Meanwhile, we urge every member of a local authority who takes his duties seriously, and all others who would like to see our cities cleaner and more attractive, to buy and read Mr. Glen's little work.

Efficient Steam Raising

Fuel Economy Monograph, No. 2. Efficient Steam-Raising. INCORPORATING PRACTICAL SUGGESTIONS FOR THE ECONOMICAL WORKING OF BOILER PLANT. FUEL ECONOMY DEPARTMENT, FEDERATION OF BRITISH INDUSTRIES. Price 2/8. pp. 39.

A gap in the Society's series of publications is one on steam-raising and boilerhouse practice that would be of use to the manufacturer, the engineer, and the stoker. When, however, there is available such a publication as that under review it is hardly necessary to do other than to persuade those concerned to purchase and study it. The first F.B.I. monograph on the subject was issued in 1921 and the new one is a re-issue of that on different and expanded lines.

It deals with the advantageous selection of fuel, the maintenance of thermal efficiency, and has notes on fuel storage and smoke abatement. Plant records for indicating the cost of fuel per 1,000 lbs. of steam output are also given.

A questionnaire form for the interchange of data for fuel cost in relation to steam-raising is given in full; and a note states that from data which have been interchanged recently in respect of a very large number of steam-raising plants in the industrial areas and within reasonable distance of the coalfields, with carefully operated plants the fuel cost per 1,000 lbs. of steam output often falls within the limits of 11d. to 13d., with, say, 12d. as an average. In some exceptional cases the fuel costs fall below 10d., and one or two even below 8d.

Smoke is considered under the three heads (a) why smoke is produced, (b) how smoke is produced, and (c) how smoke may be avoided.

Smoke is produced from the volatile matter in the coal, and to burn completely these volatile products, with the development of useful heat and the formation of smokeless gases:

(a) there must be a sufficient supply of air during the time when the volatile matter is released;

(b) there must be an intimate mixture of the air with the burning products, and

(c) the furnace temperature must be sufficiently high to enable combustion to take place rapidly and before the burning gases come into contact with the relatively cold boiler surface.

The principal causes of excessive smoke emission are, it is stated:

(a) the use of unsuitable fuel;

(b) unsatisfactory stoking, and

(c) inefficient or inadequate plant.

Then follow fourteen points showing how smoke may be avoided—a list that could with advantage be posted up in every boilerhouse.

In heavy black type it is stated that smoke is an evidence of incomplete combustion, that proper plant conditions and careful stoking are both necessary for the efficient avoidance of smoke, and that skilled stoking may result in a substantial saving of fuel.

The handbook concludes with a useful list of firms and of products connected with fuel practice.

"Efficient Steam-Raising" is to be recommended as a really practical and helpful publication.

A Smoke Abatement Pledge.

At a recent meeting of the Newcastle Healthy Life Society the following resolution was passed:

"The members of this society, after considering the facts submitted to them concerning the deadly effects of breathing smoky air and of the loss of sunshine caused by smoke, as well as the damage to property, pledge themselves to do all in their power to prevent the consumption of crude coal in such a way as to cause smoke."

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7 More Work for the Miners.
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Domestic Electric Heating

A Review of Developments and Methods.

Electric heating possesses the unique advantage of involving no consumption of fuel, and therefore no smoke, fumes or dust, at the point of application. All the combustion necessary to produce electricity itself is carried out at central power stations where the most meticulous precautions are taken to prevent the emission of smoke. From the point of view of smoke abatement, therefore, electric heating offers a clean bill.

The flow of electricity through a wire generates heat on account of the resistance offered by the wire to the passage of the current. By varying the composition and dimensions of the wire we can obtain different degrees of heat, and as the current can readily be switched on and off, either by hand or automatically, flexibility and convenience are enjoyed in addition to the hygienic advantages.

The earliest electric fires consisted of tubular lamps which were a modification of the ordinary carbon filament lamp designed to radiate heat rather than light. Some progress was also made in the early days with box-like "convectors," in which wires run at a comparatively low temperature produced a flow of warm air. The real advance of electric heating began, however, with the production of an alloy capable of resisting oxidation in the open air even when white-hot. With wires made of this alloy, wound in spirals and laid in channels upon fireclay bars, it became possible to construct electric fires with a high radiant efficiency. The fires were portable, attractive in appearance, and the bar construction lent itself to control by switches, so that part heat or full heat could be instantly obtained. All that was required for their installation was the running of heating circuits to suitable points. Used at full heat, fires of this type rapidly warmed up a room ; thereafter part heat was enough to maintain the temperature at a comfortable level.

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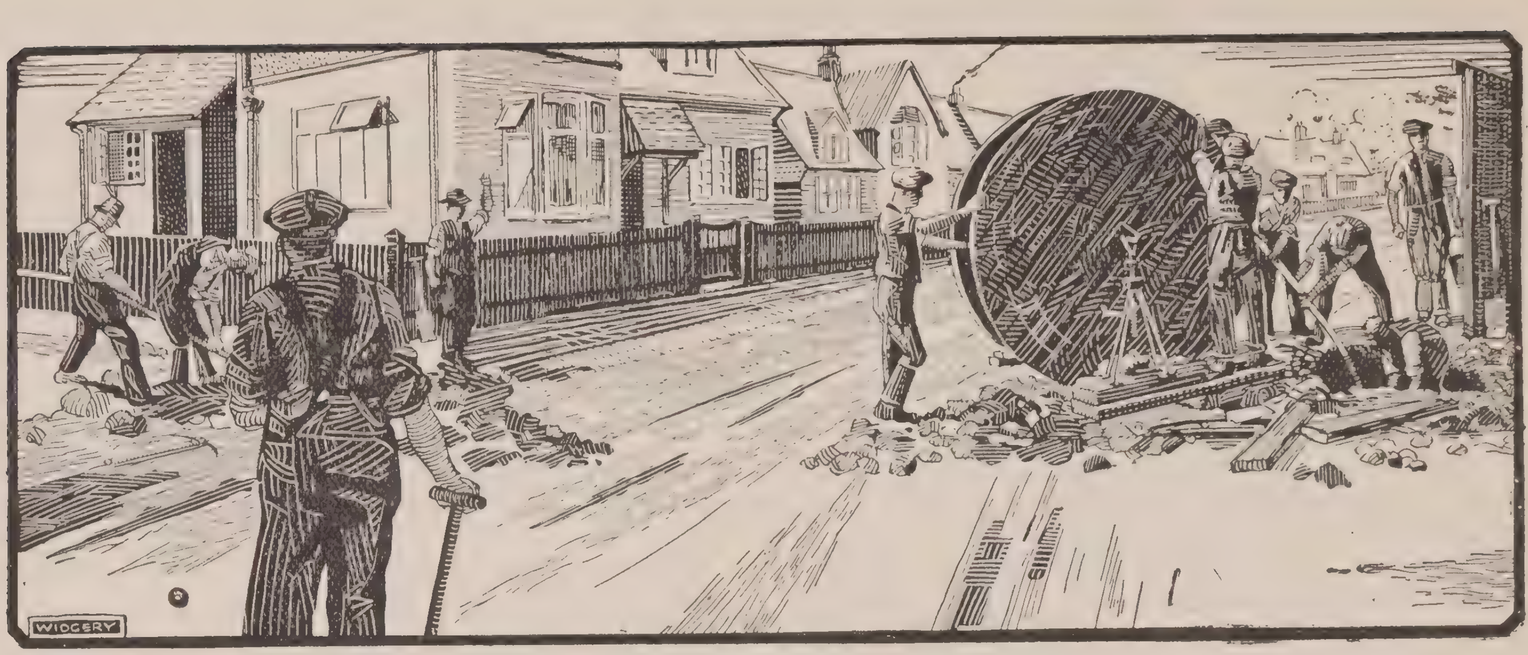
The convenience, flexibility and cleanliness of this mode of heating brought it quickly into popularity even when electricity was much less cheap than it is to-day. Our variable climate creates many calls for



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instant heating and for temporary warmth in one room or another. The coal fire—fixed in position, taking a long time to warm up and involving preparation and maintenance—was as ill adapted as the electric fire,—portable, swift in action and requiring no attention—was well adapted to changing conditions. Electric heating, therefore, brought a definite accession of comfort.

So far as the executive part of the electric fire—the heating element itself—is concerned, there has been little departure from the original form of spirals mounted on bars. Recently a flattened spiral has been introduced to increase the temperature and the radiant efficiency of the element. But in the general design of fires there has been an almost bewildering evolution.

The main lines of development have been in reflecting fires, imitation coal fires and inset fires.

Owing to the high percentage of radiant heat emitted by an electric fire and to the absence of fumes, it is possible to use reflecting surfaces freely and efficiently in directing the rays of heat and increasing the area of the glowing source of warmth. In the bowl fire, which is perhaps the most familiar form, a small conical or cylindrical element is placed at the focus of a parabolic reflector of polished copper which throws a concentrated beam of heat. Such a fire conveys a penetrating warmth to anyone sitting within its beam, even though the atmosphere itself is cold ; the effect is similar to that of sunshine in the Alps during winter.

A broader beam of heat can be obtained by arranging the element in rod form at the axis of a shield-shaped reflector. The larger surface not only spreads the heat over a wider area ; it has an important psychological effect, since a small bright surface does not convey so convincing an impression of warmth as a large one, although the heat actually provided may be the same. Some reflector fires of this class are made adjustable for use on the floor or for mounting on the wall. The latter type is ideal for bathroom use, as it is placed out of reach (a safety measure where damp is prevalent) and can be tilted, by means of cords, to throw its beam either over the bath or over the place where one is dressing or undressing. For kitchen use the same arrangement has its advantages, as it makes immediate warmth available in any part of the kitchen. Even in the bedroom it has its uses, as one over the bedhead enables an invalid to localize the warmth as desired.

ELECTRIC FIRE IN LOUNGE

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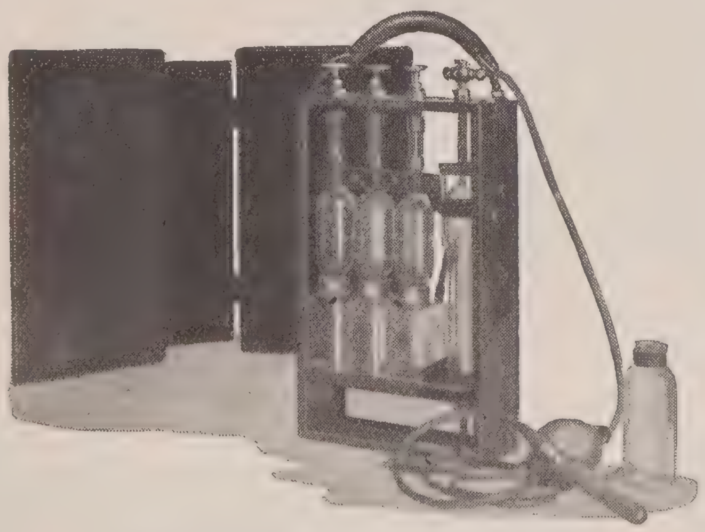

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The Imitation Coal Fire.

The imitation coal fire raises a number of problems, psychological, aesthetic and otherwise. Its introduction was a tribute to the traditional affection for the coal fire, and its success—enormous numbers are sold every year—is a tribute to the ingenuity of the designers who have produced, out of glass and other unpromising materials, a plausible replica of a flickering coal fire. No heat is emitted by the " coal " portion of the fire, except the trifling amount of heat due to the small electric lamp which produces the flicker yet experience proves that the mere appearance of the bright flicker, artificial though it be, conveys a sense of warmth which is welcome on dull and slightly chilly days. When the temperature is really low, heating by psychological suggestion is not, of course, sufficient ; radiant heat is then provided by an element which distributes its warmth directly or by reflection.

The stickler for aesthetic purity may protest that this combination of electric and pseudo-coal design is an outrage on first principles, but he is helpless against the demand for precisely this particular combination of the modern and the reproduction of the antique. Recently an effort has been made, along quite other lines, to reconcile the novel and the traditional in matters of heating. Fireplaces have been designed to accommodate either a coal fire or an electric fire. Such an arrangement may meet the wishes of those who want to make the best of both worlds, but it represents a compromise which is not very attractive from the smoke abatement point of view. Almost the only consolation is that the fireplaces are of the very latest design and consequently not likely to cause more than the minimum of smoke. It is possible, also, that the convenience, cleanliness and other advantages of the electric fire will make the occasions on which the coal fire is used more and more rare.

TUBULAR HEATING UNDER WINDOW

The inset type of electric fire ensures the fullest advantage of the saving in space effected by the adoption of electric heating. In new houses the practice is growing of reducing chimneys to one or two—the last strongholds of the coal tradition—and substituting electric fires, on panels flush with the wall, for fireplaces and flues. When properly designed and installed these inset fires transmit very little heat to the wall ; the elements are generally backed by reflectors which distribute the heat into the room. Their adoption saves space and simplifies the general design (since no provision has to be made for flues) and the result is

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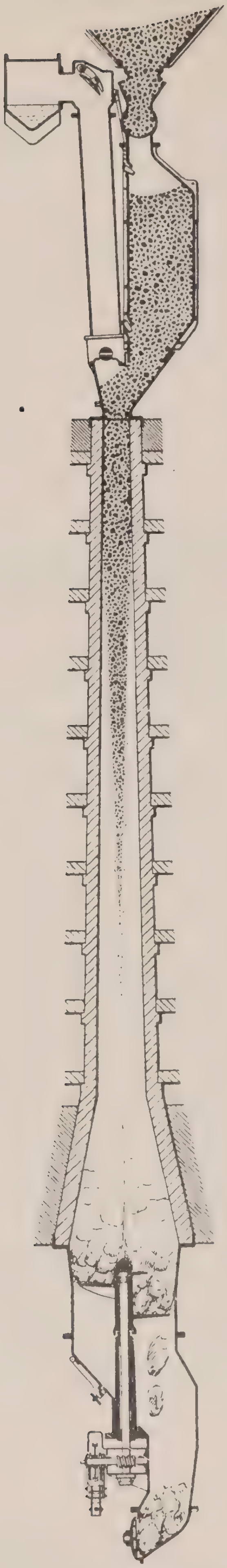

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either increased accommodation for the same building cost or a saving which enables complete electrical equipment to be provided with no addition to the usual overall expense of construction.

Low Temperature Heating.

The electric fires so far described use elements run at a high temperature, providing a glowing source of warmth. Of late years, however, important developments have taken place in low temperature heating, where the source of warmth never rises much above 150° Fahrenheit. Here the elements are encased in tubes or panels which are placed along the skirting or on the walls.

Contrary to what might be expected from " dark " sources, the larger proportion of the heat produced is given off in radiant form. The loading of the heaters the electrical consumption in relation to size—is, like the temperature, much lower than in the case of electric fires. A tubular heater, for example, takes 60 watts per foot as against 1,000 watts usual in the bar of an electric fire. By arranging the tubes or panels around a room in such a way that more warmth is afforded at colder places such as exposed windows, uniform heating is secured. Thermostatic control, by switching the current off when the room has reached the desired temperature and switching it on again when the room cools, translates the uniform heating into uniform temperature.

Low temperature heating is therefore admirably adapted to continuous use. The thermostat ensures that no current is wasted and that rapid adjustment is made to meet the vagaries of weather. Broadly, the arrangement is similar to central heating, but there are important differences due to the ease with which the heaters may be installed in strategic positions and to the accurate thermostatic control of each section of the equipment.

Apart from their regular use as the main source of warmth, tubular and other low-temperature heaters have a wide field of application in dealing with draughty corners, chilly windows and other local heating difficulties. They can also be usefully installed in airing cupboards (where the gentle warmth is quite effective and—unlike the high temperature of a bare hot-water tank—does not cause any deterioration in fabrics) and in box rooms and other apartments where occasional heat is required to keep out the damp.

Low-temperature heating is available also through the medium of electrically-heated ceiling paper and of convectors which rely for their warming effect upon the dissemination of heated air.

This brief review of electric heating methods and appliances will show that any type of heating, from bright radiant heat downwards, can be obtained in any part of the house and readily distributed and controlled either by manual or automatic means. With the gradual cheapening of electricity these benefits are being enjoyed in an ever increasing number of households and in an ever-increasing degree. Two-part tariffs for electricity are now becoming standard practice throughout the country ; under them a fixed charge, calculated on the size of the house or some similar basis, is imposed to cover the standing costs of the electrical service, and all current, whether for heating or any other purpose, is charged for at a low rate ranging in the majority of cases from 1d. down to ½d. per unit or less. With electricity on such terms the use of electric heating need not be restricted on the score of expense.

Insulation and Air-Conditioning.

Looking towards the future, there are two directions in which important developments may be expected.

The first is the use of materials which will conserve heat more efficiently than the traditional brick and lath and plaster. Partition walls and ceilings can be constructed so that they are to an unusual degree heat-insulating. They thus ensure that the warmth produced either by radiation or convection is not wasted. This heat-insulating property is useful also in summer, as it tends to keep the interior of the house cool. There is, in fact, wide scope for ingenuity in scheming the most efficient production, distribution and conservation of warmth in the house.

The other development taking place is in connection with air-conditioning. So far this system has been applied almost exclusively to hotels, offices and other commercial buildings, but its extension to the home is well within the bounds of possibility. Instead of relying upon fires and other sources of heat for warming, and upon open windows and fans for ventilation, the structure is totally enclosed and provided with a continuous supply of air at the temperature required for comfortable conditions. This arrangement implies cooling the air in summer as well as warming it in winter. Moreover, the plant filters the air and ensures the orthodox standard of humidity. For its complete application, air-conditioning involves the installation of ducts throughout the building, but partial application may be enjoyed by the installation of self-contained air conditioners in the rooms themselves.

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Correspondence

The Editor
Journal of the National Smoke Abatement Society.

SIR,

It seems to me that the proposal made by Mr. H. F. Taylor to the effect that domestic raw coal should be taxed is very ill advised. The measure would be bound to create opposition to the progress of the smoke abatement movement.

At the present time there is every indication that the public is at last becoming conscious of the waste and other evils associated with the burning of raw coal in the domestic grate and is absorbing all the smokeless fuel available, and in fact, for several years past the demand has always exceeded the supply no matter how rapidly the latter has been expanded.

In my opinion there is no doubt that no matter how rapidly the supply might be expanded, the demand would continue to exceed the supply and the day will come when we shall look back with surprised regret at the placidity with which the nation tolerated for so long the combined evils of smoke pollution and economic waste of so prodigious an order.

At the present moment something like 40,000,000 tons of raw coal are burnt annually in domestic grates. This means that we have consumed 120,000,000 gallons of the finest quality petrol and about 4,000,000 tons of crude oil. These supplies which are badly wanted for the Army, Navy and Air Force and the transport industry generally, have to be replaced by the imported article, in addition to which the burning of the volatile products causes pollution of the atmosphere which has a most detrimental effect upon the health of the whole community and the vegetation and buildings of the country generally.

Let us get away from this state of things as rapidly as possible, but it is very doubtful indeed whether any good purpose would be served by putting a tax on raw coal. What might happen when 40,000,000 tons of smokeless fuel are available each year is another matter, but that date is somewhat remote.

Yours faithfully,
W. A. BRISTOW,
President, Low Temperature Coal Distillers' Association of Great Britain. Ltd.
28, Grosvenor Place, London, S.W.1.

Smoke and Tuberculosis

The Manchester Health Report

It has for long been recognized that smoke must have adverse effects upon the incidence of pulmonary tuberculosis, or at least upon those who are suffering from that disease, but smoke abatement propagandists have not generally stressed the matter owing to the ease with which statements could be taken as maintaining that smoke actually caused tuberculosis. Non-tubercular respiratory diseases have been felt to be safer and more definite objects for discussion.

Now, however, the relation of tuberculosis to smoke has been clarified and given authoritative consideration by the Senior Tuberculosis Officer of Manchester, Dr. D. P. Sutherland. In the Report on the Health of the City of Manchester for 1933, Dr. Sutherland writes, in the tuberculosis report, as follows :

" One very potent influence to which special attention should be directed is the effect of atmospheric pollution.

" The smoke pall which is constantly present to a greater or less degree over this district has several adverse effects. It records its presence permanently in the rapid blackening and deterioration of buildings ; it reduces by something like 50 per cent. the actinic value of the available sunlight, and in winter it leads to the formation of fog. The sufferers from tuberculosis have their respiration already embarrassed by disease, and their breathing is made more difficult and distressing by the acute irritation of air-borne impurities. Further inflammation results, resistance is broken down, toxaemia increases, and heart failure follows.

" Fog, as an inimical and fatal climatic condition, is a man-made evil. The low temperatures with which it is associated do not in themselves have the deleterious influence which the true fog possesses in cases of tuberculosis of the lung.

" Pulmonary tuberculosis is an illness in the main of long duration, and in this respect it is distinct from the more acute respiratory affections of whose sufferers the winter months take a high toll. It is possible, therefore, to plot out a mean death-rate over a period of twelve months and to show how this is influenced by the occurence of periods when fog is prevalent, and further to demonstrate the more immediate mortality caused. This can be set out in the following way for the year 1933.

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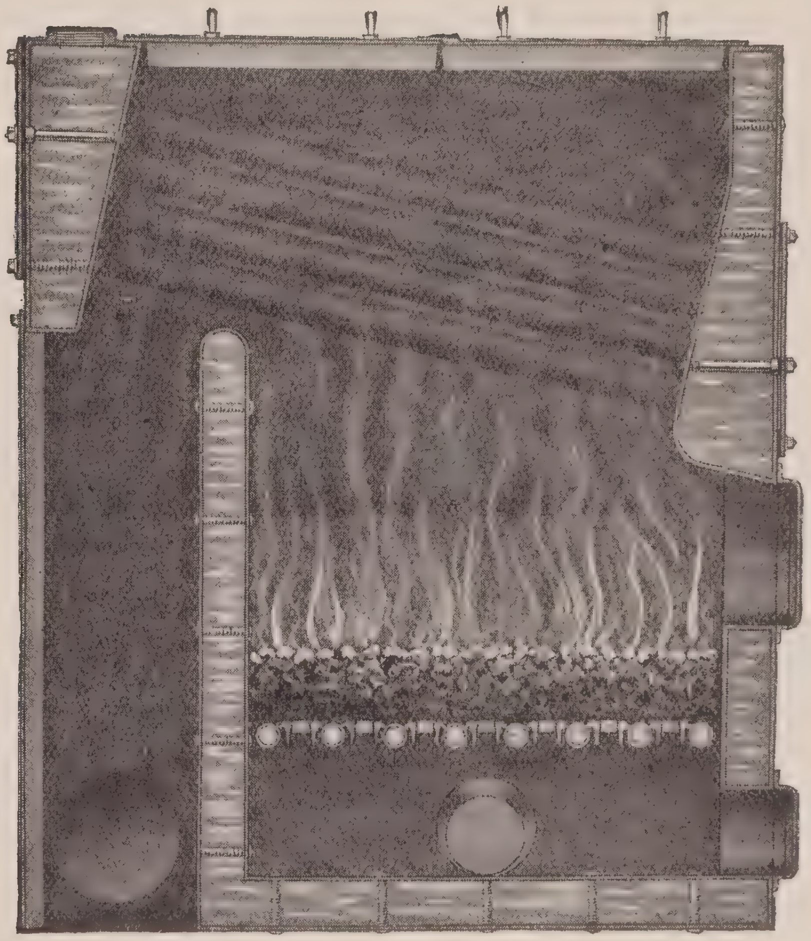

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5 Minimum Attention.
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8 Ease of Installation.
9 Minimum Space Occupied.
10 Burns Solid Fuel.
11 Most Attractive Appearance and Finish.
12 British Throughout.

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" During the fogless period from the middle of April to the third week in September, the average number of weekly deaths was 12.7. During the fogless winter months the average was 14.4, not a very marked difference in view of the remarks thta follow, and probably very little, if at all, influenced by the lowered temperature of this season.

" During the winter weeks when fog was recorded the average deaths mounted to 16.5."

The Influence of Temperature.

A chart is given in the Report which shows in a quite convincing way the association of these fogs with the increased deaths from tuberculosis. Dr. Sutherland continues by pointing out how the chart " illustrates also the immediate influence upon the mortality, as the greater number of deaths occur in almost every instance in the weeks when the fogs are more intense. After each visitation of fog with its accompanying death roll, there remains also for a time an abnormally raised mortality, due in my opinion directly to the fog's influence. It has been stated that the temperature conditions do not appear to be a serious factor, and this receives support from the records. These show that in no instance is the lowest mean temperature coincident with the highest death rates. It is to be noted that this observation does not apply to other respiratory deaths, and the low temperatures do certainly appear to be associated directly in these non-tubercular illnesses with increased mortality. But many diverse factors would have to be considered here, as the group of diseases mentioned is a very varied one and the influence of the infective agencies, the accuteness of the illness—the age of the patients—the duration of disease, might all have a bearing.

Another way of considering this question of temperature and fog is as follows :—

" The highest mortality from pulmonary tuberculosis in consecutive foggy weeks occurred at the beginning of the year. These deaths averaged 22 a week. The mean temperature in these six weeks was 38.9°F.

" The coldest six weeks of the year gave a mean temperature of 35.4°F., and these again were all weeks with fog occuring. The deaths in these six weeks averaged 18.8.

" In the first of these periods of six weeks there were fourteen foggy days, and in the second thirteen foggy days. The resulting findings, therefore, are that the mortality is increased from 18.8 to 22 a week in that period of six weeks when fog was a little more prevalent i.e., fourteen as compared with thirteen days, but when the mean temperature was 3.5°F. higher.

" The lowered temperature, apart from its influence in causing fogs, did not in any way produce an ill effect as measured by the deaths.

" Finally, the six weeks of highest mortality gave weekly average deaths of 23.8. During this six weeks there were 19 days of fog. The mean temperature during this period was 39.4°F. This again supports the findings arrived at above in other ways.

" The conclusion to be drawn is perfectly clear. It is that the presence of fog has a definitely proved influence in causing deaths from pulmonary tuberculosis. These deaths are brought about in many instances immediately the fog occurs, in some cases within a few days. In others death is accelerated, and though not occurring so immediately, the end is undoubtedly hastened.

" The causation of fog is well known and preventable, and increased efforts are called for in order to secure its diminution and the diminution of the death roll due to it."

An Old Rhyme made Modern.

Mr. Philip M. Oliver, of Manchester, proposing the toast of " The Gas Industry," at a recent lunch held in connection with a B.C.G.A. District Conference, spoke of the value of gas in promoting smoke abatement, and, amid laughter, said :

" A gas fire in your room and the sun in the skies,
Makes a man healthy, wealthy and wise."

". . . those who put up magnificent business buildings that are repulsively begrimed before they are finished ; who cannot see the dirt for the size, and boast grandly of their monuments while they rain soot upon them . . ."—*Booth Tarkington, in " The World do Move."*

" It is the eternal smudge on the nose," says a newspaper woman, " that has put a powder puff in every woman's handbag."

Exhaust Fumes.

Mr. Hore-Belisha, in the House of Commons on November 1st, told Mr. Parkinson that the report of a Home Office Departmental Committee, which considered the harmful effects of fumes from motor vehicles on the general health of the public, did not suggest that there was such evidence of injury as would justify legislative action.

Our New Publications.

" The Law Relating to Smoke and Noxious Fumes." By R. A. GLEN. Price 1/-.

" Proceedings of the Glasgow Conference." 72 pages. Price 1/-.

" The Smokeless Home." Gratis.

News and Views

The Conference Resolutions.

The first of the two resolutions passed at the Conference, moved by Mr. L. H. Dibblin, of Willesden, read as follows :

"That this Conference of the National Smoke Abatement Society recommends that the Government set up a Committee to investigate and report upon measures to be employed to abate nuisances arising from the use of pulverized fuel, and that special consideration be given to the abatement of nuisance arising in connection with generating stations or other statutory undertakings.

"That all Local Authorities be circulated asking them to pass a resolution on similar lines and that such resolution be sent to the Minister of Health and their respective Members of Parliament."

The second resolution was moved by Councillor W. Asbury, the Chairman of the Sheffield, Rotherham, and District Regional Smoke Abatement Committee. It was as follows :

"That this Conference views with grave concern the slow progress made towards the solution of the domestic smoke problem, and urges on the Government in any new housing legislation to insist, as a condition of subsidy, that the heating arrangements in all houses to be erected under such legislation shall be of such a design as will obviate atmospheric pollution."

These resolutions have been forwarded to the Minister of Health and will shortly be circulated to all local authorities, accompanied by explanatory memoranda.

National Council of Women Resolution.

The Society, as an affiliated member of the N.C.W. sent in a resolution on smoke abatement to be balloted upon for discussion at the annual meeting of the Council. This is the first year that a smoke abatement resolution has been sent up, and it was not selected for the final agenda. It was worded as follows :

"The National Council of Women, recognizing with concern the serious consequences to public health and amenity arising from the emission of coal smoke, from both industrial and dwelling-house chimneys, and deploring the excessive domestic labour and economic waste that it occasions, urges its members and affiliated societies to stimulate by all means available to them a wider public understanding of the evil and its consequences, and to encourage the use of smokeless methods and mediums for domestic purposes.

"The National Council of Women further urges all housing authorities to take steps to ensure the greatest practicable degree of smokelessness in all new housing estates, whether municipal or privately built, and in rebuilt areas."

Publications Received.

"Note sur la composition des eaux resultant de la fonte des neiges" by G. Batta and Ed. Leclerc. Extract from the Bulletin de la Societé Chemique de Belgique, Tome 40, 1931.

B.C.G.A. Publications : "Cooking with Prefect Control." "Gas in Housing and Slum Clearance." "Town Gas for Plastic Moulding."

"Oil and Coal." Report and Proceedings of the Summer Conference of the Institution of Petroleum Technologists.

"28th Annual Report of the Bengal Smoke Nuisances Commission."

"Smoke," the Official Bulletin of the Smoke Prevention Association Inc. (U.S.A.) monthly.

"Le Véhicule Électrique," July, 1934. Societé pour le Development des Véhicules Electriques. Paris. Quarterly.

"Notes on the Visit of the Institution of Gas Engineers to Canada and the United States of America, 1933," by F. J. Dent, Ph.D., B.Sc. Institution of Gas Engineers. Price 1s. 6d.

"Fuel Economy Review," 1934. Federation of British Industries. Price 2s. 6d.

The Northumberland and Durham Regional Committee.

The proposal is under discussion that the Northumberland and Durham Regional Smoke Abatement Committee should appoint an advisory smoke inspector for the area covered by the constituent authorities. £400 would be required for salary and travelling expenses, and the bulk of the sum would be contributed by Newcastle, South Shields, and Sunderland. If this valuable step is accomplished the North-East coast will be the first advisory committee to employ an inspector.